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ANNUAL FISH POPULATION
AND
ANGLER USE, HARVEST AND PREFERENCE SURVEYS
ON
LAKE SHARPE, SOUTH DAKOTA 2002

South Dakota
Department of
Game, Fish and Parks
Wildlife Division
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ANNUAL FISH POPULATION
AND
ANGLER USE, HARVEST AND PREFERENCE SURVEYS
ON
LAKE SHARPE, SOUTH DAKOTA, 2002

by

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PREFACE

Information collected during 2002 is summarized in this report. Copies of this report and references to the data can be made with permission from the authors or Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, South Dakota 57501-3182.

The authors would like to acknowledge the following individuals from the South Dakota Department of Game, Fish and Parks and South Dakota State University , who helped with data collection and analysis, manuscript preparation, and report editing; Brian Beel, Kristin Berg, Andy Carda, Blake Davis, Brian Graeb, Robert Hanten, Matt Heard, Darla Kusser, Jim Riis, Sylvester Schied, Robert Schunot, and Cliff Stone.

The collection of data for these surveys was funded, in part, by Federal Aid in Sport Fish Restoration, (D-J) project F-21-R-34, Statewide Fish Management Surveys. Some of these data have been presented previously in segments F-21-23 through 33, and South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 96-7.

EXECUTIVE SUMMARY

This report includes annual fish population data from 1998 through 2002 and angler use, harvest and preference data for 2002, for Lake Sharpe, South Dakota. Angler use and harvest survey data from previous years is also referenced in this report. Results of these surveys are used to evaluate progress towards strategic plan objectives as outlined in the Missouri River Fisheries Program Strategic Plan. Data interpretation and discussion relate to changes in fish community and population structure, angler use, harvest, and preference, and evaluation of management activities and regulations.

Seventeen fish species were collected with gill nets in the 2002 Lake Sharpe fish population survey. Mean catch per unit effort (CPUE) values for all species, for 2002, were similar to 2001 values, with the exception of channel catfish. Mean CPUE of channel catfish in 2002, at 20.1 fish/net-night, was significantly higher than the 2001 value of 9.0 fish/net-night and higher than both the five-year average (11.1 fish/net-night) and the 1982-2002 average (8.3 fish/net-night).

The 2002 walleye mean CPUE of 24.1 walleye/net-night in the standard gill-net survey, was similar to the 5-year average of 26.5 walleye/net-night. Based on age interpretation from scale samples, the 1999-year class comprised 26% of the walleye catch, followed by the 1998 and 2000 year-classes at 24% and 23%, respectively. Length at annulus and growth increment estimates calculated from scale samples for walleye collected in 2002 were comparable to length and growth increments calculated for walleye collected in the 2001 survey. Walleye *Wr* values for stock-to-quality-length walleyes collected in the 2002 gill net survey were significantly lower than for fish of the same length category in the 2001 survey, though still within the range observed during the 1997-2002 period. Walleye population size structure, as indexed by PSD values, was within the balanced range of 40-60. Walleye reproductive success during 2002, as indicated by seining, gill netting, and fall electrofishing, was low.

Anglers fished an estimated 385,357 hours (89,827 angler days) on Lake Sharpe during daylight hours of April-September, 2002. Peak fishing pressure in 2002 occurred in June at an estimated 99,769 hours. An estimated 210,781 fish were harvested during the daylight hours of April-September, 2002. The estimated walleye harvest for the April-September 2001 daylight period, at 144,065 walleye, surpassed the Lake Sharpe Strategic Plan sustainable harvest objective of 100,000 walleye by over 44,000 fish but was 30% lower than the record harvest estimate of 207,144 walleye, for 1998. The mean catch rate for walleye, for the April-September 2002 daylight period, was 0.99 fish/angler-h. Eighty percent of angling parties indicated some degree of satisfaction, surpassing the Lake Sharpe Strategic Plan objective of 70%.

The majority of resident anglers fishing Lake Sharpe during the April-September 2002 daytime period were from Hughes (36%), Minnehaha (13%), Beadle (9%), Stanley (8%), and Pennington (6%) counties (Figure 9) . Non-residents comprised 28% of angler contacts on Lake Sharpe, during the April-September 2002 daylight period. For the April-September 2002 daylight period, Lake Sharpe anglers contributed approximately 6.7 million dollars to local economies, based on an estimated 89,827 trips at an estimated $75 per trip for South Dakota's Missouri River reservoirs.

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ANNUAL FISH POPULATION AND ANGLER USE HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2002

INTRODUCTION

Anglers spent over 2.0 million hours fishing the Missouri River system in South Dakota in 2002 (Lott et. al 2003; Stone and Sorenson 2003, this study). In a recent angler use and preference survey (Mendelsohn 1994), 500 of resident respondents listed Missouri River reservoirs as their preferred fishing area. South Dakota Department of Game, Fish and Parks (SDGFP) recognizes the importance of the Missouri River fisheries program and considers it a major program in current strategic planning efforts (SDGFP 1994).

Lake Sharpe is a 128-km long mainstem Missouri River flow-through reservoir and has a surface area of 24,686 ha. Lake Sharpe has supported between 60,000 and 100,000 angler trips, during the April-September daylight period, in recent years (Stone et al. 1994, Johnson et al. 1998, Johnson and Lott 1999, 2000, 2001, Johnson et al. 2002). Walleye, and to a lesser extent, smallmouth bass, white bass, channel catfish, sauger, and rainbow trout, provide most of the sport fishing opportunity in this reservoir. Current fish population parameters and sport fisheries are good, based on fish abundance and angler catch rates.

Lake Sharpe is an important fisheries resource in South Dakota and its habitat and fish community must be protected and maintained. The importance of Lake Sharpe to Missouri River fisheries is documented in the goal, objectives and strategies developed for management of this system (SDGFP 1994). Conducting annual surveys documenting fish community and population parameters, in association with collecting data on angler use, harvest, attitudes, preferences, and level of satisfaction, are primary strategies outlined in that plan. This information is required for evaluation of objectives and strategies and to identify future management strategies. Trends and status of fish populations discussed in this report provide valuable information for evaluation of walleye regulations implemented in 1999. This report includes data collected for Lake Sharpe in 2002 and comparisons to data from previous years.

OBJECTIVES

The objectives of the surveys discussed in this report are to provide information on or estimates of:

Annual fish population surveys (Federal Aid Code 2102):

1. species composition
2. relative abundance
3. population age structure
4. growth
5. condition
6. recruitment
7. survival and mortality rates
8. population size structure
9. effects of regulations

10. effects of sport fish harvest

Angler use, harvest, and preference surveys (Federal Aid Code 2109):

1. recreational angling pressure
2. fish harvest, release and catch rates, by species
3. angler party size, day length, and state of residency
4. annual local economic impact of the sport fishery
5. effects of regulations and other management activities
6. size structure of fish in the harvest
7. angler preference, attitude and satisfaction information

STUDY AREA

Lake Sharpe **is** located in central South Dakota (Figure 1) and extends from Oahe Dam to Big Bend Dam. The reservoir has been divided into three zones for survey purposes. The upper zone extends from Oahe Dam to the downstream end of LaFramboise Island, the middle zone extends from the downstrean end of LaFramboise Island to DeGrey, and the lower zone extends from DeGrey to Big Bend Dam. Standard gill netting, seining and electrofishing locations are Farm Island, DeGrey, Joe Creek and North Shore. Electrofishing is also conducted at LaFramboise Island and the Oahe Dam stilling basin. Historical, biological, chemical and physical parameters have been discussed previously (Benson 1968, Riis 1986, Schmidt 1975). Table 1 presents selected physical characteristics, management classification and fish population survey schedules for Lake Sharpe.

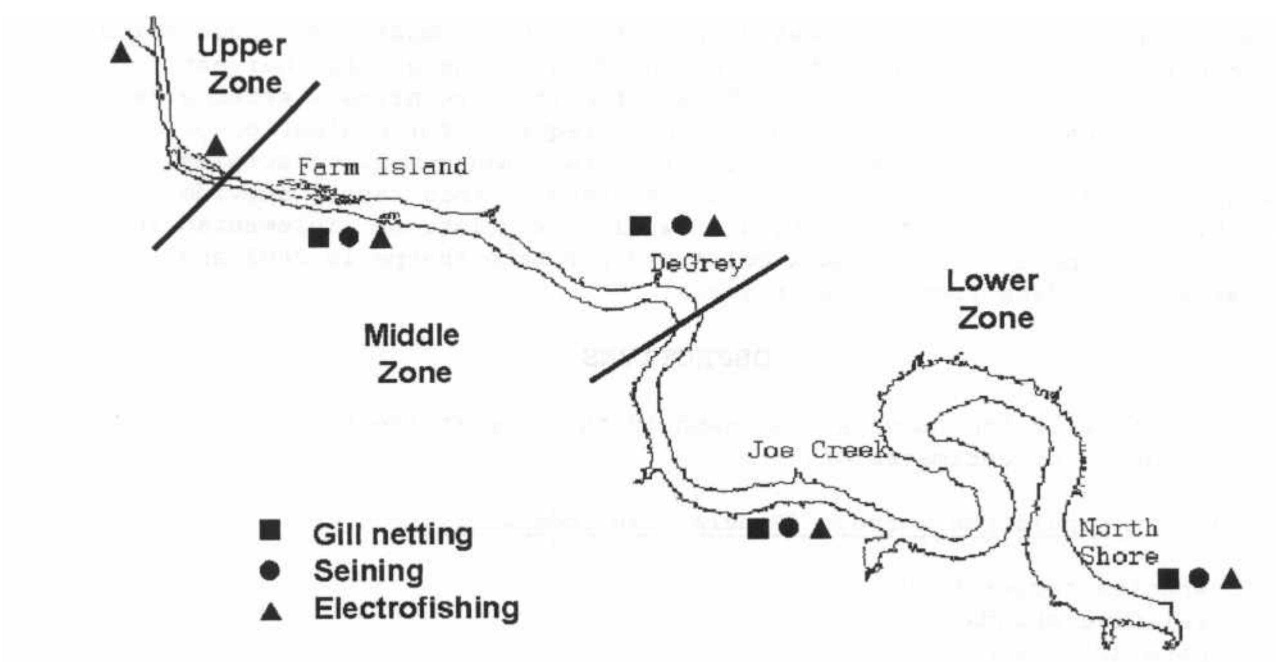

Figure 1. Lake Sharpe, South Dakota, gill netting, seining and electrofishing locations.

Table 1. Physical characteristics at normal pool elevation, management classification, and sampling times and depths, for annual fish population surveys on Lake Sharpe, South Dakota.

Characteristic:	Description
Location:	From Oahe Dam to Big Bend Dam
Surface area (X 1000 ha):	25
Depth (m)-maximum: **-mean:**	23.5 9.5
Bottom substrate:	Sand, gravel, shale and silt
Water source:	Missouri River and tributaries
Management classification:	Cool and warm water permanent
Gill net depths: (m)	0 - 9.1 9.1 - 18.3
Number of gill nets:	24
Gill netting survey date:	August
Number of seine hauls:	16
Seining survey date:	August
Nighttime electrofishing	May-June, September-October

SAMPLING METHODS

FISH POPULATION SURVEYS

Data Collection

Variable-mesh gill nets, seines and boat electrofishing were used to sample fish populations in Lake Sharpe during 2002 (Figure 1) . Three standard gill nets (Lott et al. 1994) were fished overnight, on the bottom, in each depth zone (0-9.1 m and >9.1 m), where possible, at each location (Table 1, Figure 1). All fish collected were identified and counted. Stock-length fish (Anderson and Weithman 1978) of all species sampled were measured for total length (TL; mm) and weighed (g). Scale samples and otoliths (10 per cm length group per sampling location) were collected from walleye and sauger. Scales were removed from a location below the lateral line and at the tip of the pectoral fin (Al-Absy and Carlander 1988). Otoliths were removed from all walleye sampled in gill nets. Whole otoliths were aged for walleyes age-5 and younger, while otoliths from older fish were, broken in half prior to aging.

Nylon seines, previously described by Lott et al. (1994), were used to collect age-0 fishes and small littoral species. A quarter-arc seine haul was accomplished by methods described in Martin et al. (1981). Four seine hauls were made at each sampling location. All fish collected with seines were identified and counted.

Spring (May and early June), nighttime electrofishing and angling events were used to capture smallmouth bass for age-and-growth and condition analyses. Smallmouth bass captured were measured (TL; mm), weighed (g) and scales were taken from 10 smallmouth bass per centimeter length group, on each electrofishing or angling sampling date. Smallmouth bass >_200 mm (TL) collected by angling and electrofishing were each tagged with two external tags of different types to evaluate tag retention. Fish that were tagged had an individually numbered t-bar anchor tag attached at the base of the soft dorsal fin and either a uniquely numbered internal anchor tag attached through the abdominal wall or a streamer tag inserted at the junction of the upper and lower mandible.

Fall, nighttime electrofishing for age-0 walleye was included in standard fish population surveys beginning in 1995 to assess walleye reproduction. Beginning in 1998, a sampling location was included at DeGrey to provide uniformity between electrofishing, seining, and gill-netting survey sites. In 2000, electrofishing sites at LaFramboise Island and the Oahe Dam stilling basin were added to the list of standard electrofishing sites. Six, 15-minute electrofishing runs were conducted at night, during September, along the shoreline, at each sampling location. A 5.3-m Smith-Root SR-18 electrofishing boat, with a 5.0 GPP electrofisher, was used to conduct the survey. The electrofishing unit was set for pulsed D.C. current and a 30 pulse/sec frequency. Voltage and amperage ranged between 270-300 V and 7-10 A, respectively. Scales were taken from a representative sample of walleye <200-mm in length to determine the maximum length for age-0 fish.

A list of common names, scientific names, and species abbreviations for fish mentioned throughout this report is presented in Appendix 1.

Data Analysis

Relative abundance of fish species were expressed as mean catch per unit effort (CPUE) for standard gill net (No./net night), seine (No./haul) and electrofishing (No./h) catches. A standard net night for the gill-net survey was approximately 20 h. Age and growth analyses were conducted for walleye, sauger, and smallmouth bass. Scales were aged according to standard techniques (DeVries and Frie 1996). Back-calculations were made with the computer program WinFin Analysis (Francis 2000) . Standard y-intercept values for growth analyses of 55 mm, for walleye and sauger, and 35 mm for smallmouth bass (Carlander 1982) were used. Age distributions for gill-net catches of walleye and sauger were developed by assigning ages to all fish captured during the survey, based on length-at-age-at-time-of-capture information. Proportional stock density (PSD; Anderson 1980) and relative stock density (RSD; Gablehouse 1984) values were calculated for walleye, sauger, channel catfish, white bass, and yellow perch. Length categories used in PSD and RSD calculations for walleye, sauger, channel catfish, white bass and yellow perch are listed in Table 2.

Relative weight values (*Wr;* Anderson 1980) were calculated using standard weight (W_5) equations developed for walleye (Murphy et al. 1990), sauger (Guy et al. 1990), channel catfish (Brown et al. 1995), white bass (Brown and Murphy 1991) and yellow perch (Willis et al. 1991). Standard weight equations used in this report are provided in Appendix 2. Stock density indices (PSD, RSD) and mean *Wr* values for channel catfish, white bass and yellow perch are presented in Appendix 3.

Table 2. Minimum lengths (mm) for length class designations for walleye, sauger, channel catfish, white bass and yellow perch.

Species	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth Bass	180	280	350	430	510
Walleye	250	380	510	630	760
Sauger	200	300	380	510	630
Channel catfish	280	410	610	710	910
White bass	150	230	300	380	460
Yellow perch	130	200	250	300	380

Walleye *Wr* values for fish in gill net samples were tested for differences among years, within stock density index groupings, using a one-way ANOVA (SYSTAT 1998). Length and CPUE of age-0 walleye in fall electrofishing samples were tested for differences among years using a one-way analysis of variance (ANOVA). Standard error values were generated for gill net and seine haul mean CPUE values as a measure of sample variance. An alpha level of 0.05 was established, a priori, for all statistical tests.

Survival and mortality estimates for walleye were calculated using catch curves (Ricker 1975). To reduce the effects of variable recruitment, two consecutive years of age-distribution data were combined for analyses. To estimate instantaneous mortality rates (Z), the slope of the regression of the natural logarithm of the number of fish of each age on fish age was used. Simple linear correlation analyses were done between indices of walleye recruitment (age-0 seining, age-0 gill net, age-0 electrofishing and age-1 gill net CPUE). Multiple regression analyses comparing indices of walleye recruitment included the addition of mean length of age-0 walleye in the fall nighttime electrofishing survey as a dependent variable.

ANGLER USE AND SPORT FISH HARVEST SURVEYS

Reservoir-Wide Angler Use and Harvest Survey

Angler use and sport-fish harvest survey techniques were patterned after a study designed and conducted on Lake Sharpe, South Dakota, by Schmidt (1975). This survey allowed an economically feasible, statistically accurate method of estimating fishing pressure and harvest on large Missouri River reservoirs. The survey consists of two independent parts. First, aerial pressure counts were used to estimate fishing pressure. Second, angler interviews were used to obtain estimates of individual angler harvest and catch and release rates. Mean party size, size structure of harvested fish, mean angler day length and angler residency were also determined from angler interviews. Results of these surveys were combined to estimate total harvest.

Sampling was conducted from April 1, 2002 through September 30, 2002 for the sunrise-to-sunset (daylight) period. Pressure counts were made from an airplane during all months. For a more detailed description of the aerial count and angler interview techniques see Stone et al. (1994) . Pressure count and angler interview data were entered and analyzed using the Creel Application Software (CAS) package (Soupir and Brown 2002) and 95% confidence intervals were calculated for estimates of fishing pressure and harvest.

ANGLER PREFERENCE SURVEY

Angler preference questions were included in each angler interview during the 2002 reservoir-wide angler use and harvest survey. Two different versions (forms A and B) of the angler interview data sheet were created, with different sets of angler attitude or preference questions on each sheet. Clerks alternated between forms A and B during each scheduled survey day. Anglers were asked to rate their fishing trip based on the numbers and sizes of fish they were expecting to catch and to state how satisfied they were with their fishing trip, considering all factors. Other questions asked were related to smallmouth bass management preferences and potential regulation options. A list of attitude and preference questions used during the 2002 survey appears in Appendix 4. Median values for trip rating and satisfaction question responses were calculated for each month and for the entire sample.

RESULTS AND DISCUSSION

FISH POPULATION SURVEYS

Species Composition and Relative Abundance

Seventeen fish species were collected with gill nets in the 2002 Lake Sharpe fish population survey (Table 3). All fish species collected during 2002 had been previously sampled in Lake Sharpe (Michaletz et al. 1986, Riis et al. 1988, Stone et al. 1989, Johnson et al. 1990, Wickstrom et al. 1991, Johnson et al. 1992, Wickstrom et al. 1993, Lott et al. 1994, Riis and Johnson 1995, Riis et al. 1996, Riis et al. 1997, Johnson et al. 1998, Johnson and Lott 1999, Johnson and Lott 2000, Johnson et al. 2002). Mean catch per unit effort (CPUE) values for all species, for 2002, were similar to 2001 values, with the exception of channel catfish and gizzard shad (Johnson et al. 2002). Mean CPUE of channel catfish in 2002, at 20.1 fish/net-night, was significantly higher than the 2001 value of 9.0 fish/net-night and higher than both the five-year average (11.1 fish/net-night) and the 1982-2002 average (8.3 fish/net-night). Mean gizzard shad CPUE for 2003, at 3.3 fish/net-night was not significantly different than the 2001 value of 13.7 fish/net night or the five year average of 6.9 fish/net-night, due to high sample variances. Mean gizzard shad CPUE in the gill net survey has varied between 0.3 and 51.5 fish/net night during the 1982-2002 survey period and is highly dependent on the number of shad produced the previous year that overwintered and if age-0 shad are long enough to be captured in 13-mm mesh at the time the gill net survey is conducted. Walleye was the most abundant species in the gill net catch followed by channel catfish, sauger, white bass, and gizzard shad (Table 3; Figure 2).

Ten species of age-0 fishes and six species of small prey fishes were collected during the 2002 standard seining survey in early August (Table 4). Gizzard shad dominated seine haul catches, at a mean CPUE of 1,459.7 fish/haul. The next most abundant prey species in the 2002 seining survey was emerald shiners, with a mean CPUE of 46.6 fish/haul. Spottail shiner mean CPUE for the 2002 seining survey, at 4.9 fish/haul, was significantly lower than the 2001 value of 13.9 fish/haul and lower than the five-year and 1982-2002 averages.

Population Parameters for **Walleye**

Walleye ranging from 85 to 575 mm TL (Figure 3) and representing ten year-classes (Table 5) were collected during the August 2002 gill net survey. The 2002 walleye mean CPUE of 24.1 walleye/net-night in the standard gill-net survey, was similar to the 5-year average of 26.5 walleye/net-night. Based on age interpretation from scale samples, the 1999-year class comprised 26% of the walleye catch, followed by the 1998 and 2000 year-classes at 24% and 23%, respectively (Table 5). However, when ages were interpreted from otolith samples, the percentage of fish from the 2000 and 1999 year classes were similar at 26% and the 1998 year class comprised 22% of the gill net catch (Table 5). Mean CPUE of age-0 walleye was high in 1994 and 1995 (Figure 4) and these year classes are still represented in the walleye, as was evident from the 2002 walleye population age-structure based on otolith age interpretation (Table 5). Examination of the length frequency histogram for the 2002 walleye gill net sample (Figure 3), in association with mean back-calculated length at age data (Table 6) suggests the majority of walleyes between 300 and 380-mm in length are from the 1999 and 2000 year classes (age-2 and age-3 fish) . The majority of walleye between 381 and 457-mmin length in the 2002 gill net survey were from the 1998 year class. Mean growth rate values for walleye in Lake Sharpe (Table 6) are lower than mean values for South Dakota and the Missouri River reservoirs (Willis et al. 1991) though higher than the unweighted mean reported by Carlander (1997) for Michigan, Minnesota, and Wisconsin.

Length at annulus (Table 6) and growth increment estimates (Table 7) calculated from scale samples for walleye collected in 2002 (representing 2001 growth) were comparable to length and growth increments calculated for walleye collected in the 2001 survey, (representing 2000 growth) . Walleye growth rates for Lake Sharpe are generally similar to walleye growth rates for Lake Francis Case (Stone and Sorensen 2003). Both Lakes Sharpe and Francis Case have gizzard shad as the main prey fish for walleye (Wolf et al. 1994, Stone and Sorensen 2001).

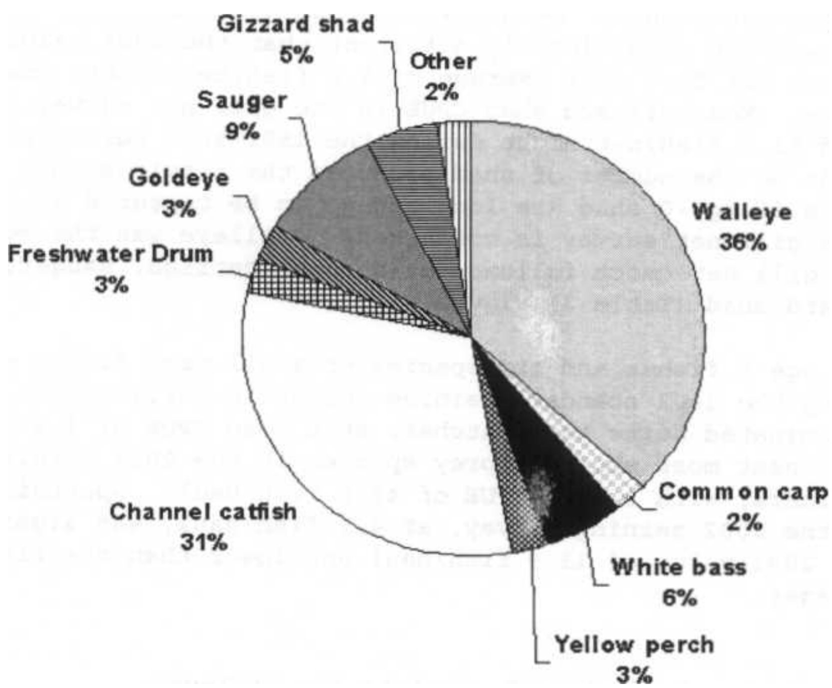

Figure 2. Relative species composition of fish collected from Lake Sharpe, South Dakota, during the August 2002 gill-net survey.

Scale and otolith samples were both collected from walleye in the 2002 standard gill net survey and ages determined for individual fish were compared to assess trends in age determination among structure type. Ages determined from scales and otoliths for individual fish agreed 95% of the time for fish aged as age-1 for scales, and agreed 79%, 74% and 75% of the time for fish aged as age 2, 3, and 4 from scales, respectively (Table 8). However, percent agreement for between structures decreased to 42% for fish aged age-5 from scales. Scales tended to under-estimate ages of walleyes aged as age-5 and older from otoliths, possibly because outside annuli on scales are reabsorbed during periods of slow or negative growth.

Table 3. Mean catch per unit effort for fish species collected with standard gill net sets in Lake Sharpe, South Dakota, 1998-2002. Trace (T) indicates values >0.0 but <0.05. Standard error values are in parentheses.

Species	Year				
	1998	1999	2000	2001	2002
Bigmouth buffalo	T	0.0	T	T	0.0
Black bullhead	0.0	0.0	T	0.0	0.0
Black crappie	T	0.0	0.0	0.0	0.1 (0.1)
Bluegill	0.0	0.0	T	0.0	0.0
Blue sucker	T	0.0	0.0	0.0	0.0
Channel catfish	5.0 (1.0)	9.2 (0.6)	11.9 (2.3)	9.0 (1 7)	20.1 (4.5)
Chinook salmon	0.1 (0.1)	0.0	0.0	0.0	0.0
Common carp	1.3 (0.3)	2.4 (0.4)	2.0 (0.6)	1.9 (0.6)	1.4 (0.3)
Freshwater drum	0.3 (0.2)	1.0 (0.3)	0.8 (0.3)	1.7 (0.5)	1.7 (0.7)
Gizzard shad	11.8 (4.3)	3.1 (0.6)	2.4 (1.1)	13.7 (4.9)	3.3 (1.5)
Goldeye	1.4 (0.7)	2.6 (0.7)	1.5 (0.7)	1.5 (0.8)	1.9 (1.0)
Lake herring	T	0.0	0.0	0.0	0.0
Northern pike	0.5 (0.3)	0.2 (0.1)	T	0.1 (0.1)	T
Rainbow smelt	0.7 (0.6)	0.1 (0.1)	T	0.0	0.0
Rainbow trout	0.0	0.0	0.1 (0.1)	T	0.0
River carpsucker	0.6 (0.4)	0.8 (0.3)	1.5 (0.6)	1.7 (0.5)	0.1
Sauger	3.2 (1.0)	4.2 (0.4)	7.1 (1.8)	5.2 (1.5)	5.6 (1.3)
Shorthead redhorse	0.5 (0.3)	0.7 (0.2)	0.5 (0.2)	0.3 (0.1)	0.5 (0.2)
Shortnose gar	0.0	0.1 (0.1)	0.2 (0.2)	0.1 (0.1)	T
Shovelnose sturgeon	1.0 (0.4)	0.8 (0.3)	0.4 (0.2)	0.8 (0.7)	0.8 (0.4)
Smallmouth bass	0.1 (0.1)	0.6 (0.3)	0.8 (0.5)	0.9 (0.7)	T
Smallmouth buffalo	0.0	T	T	0.0	0.0
Spottail shiner	0.4 (0.3)	0.1 (0.1)	0.0	T	0.0
Walleye	21.5 (4.3)	25.4 (0.9)	25.8 (4.5)	28.3 (5.4)	24.1 (5.1)
White bass	1.6 (0.1)	2.5 (0.4)	2.7 (1.2)	2.8 (1.4)	3.7 (1.3)
White crappie	1.2 (1.1)	0.3 (0.2)	0.9 (0.7)	0.2 (0.2)	0.1 (0.1)
White sucker	0.0	0.1 (0.1)	0.0	0.1 (0.1)	0.0
Yellow perch	1.5 (0.8)	2.3 (0.4)	1.8 (0.8)	1.3 (0.5)	1.6 (0.6)

Table 4. Mean catch per seine haul for fish species in Lake Sharpe, South Dakota, 1998-2002. Catches are for age-0 fishes, except where noted. Standard error values are in parentheses.

Species	Year				
	1998	1999	2000	2001	2002
Bigmouth buffalo	0.0	0.0	0.1 (0.1)	0.0	0.0
Black crappie	0.1 (0.1)	0.5 (0.4)	0.0	0.0	0.0
Bluegill	0.1 (0.1)	8.8 (1.4)	0.1 (0.1)	0.0	0.1 (0.1)
Bluntnose minnow*	0.0	0.1 (0.1)	0.5 (0.4)	1.2 (0.8)	5.0 (2.6)
Brassy minnow*	0.0	0.0	0.0	0.1 (0.1)	0.0
Channel catfish	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	0.0	0.1 (0.1)
Common carp	0.0	0.0	0.0	0.8 (0.4)	0.0
Emerald shiner*	29.1 (12.8)	30.4 (1.9)	16.8 (5.4)	72.4 (30.6)	46.6 (15.3)
Fathead minnow*	0.0	0.1 (0.1)	0.0	0.2 (0.1)	0.6 (0.5)
Freshwater drum	8.0 (4.5)	0.8 (0.4)	0.5 (0.2)	11.8 (6.4)	3.8 (1.7)
Gizzard shad	324.3 (193.3)	696.6 (10.8)	791.6 (393.6)	603.6 (241.8)	1,459.7 (644.7)
Goldeye	0.8 (0.8)	0.4 (0.2)	0.0	0.3 (0.3)	0.0
Green sunfish	0.1 (0.1)	0.0	0.0	0.0	0.0
Johnny darter*	0.0	0.0	0.4 (0.2)	0.1 (0.1)	0.1 (0.1)
Largemouth bass	0.1 (0.1)	1.9 (0.7)	0.0	0.1 (0.1)	0.1 (0.1)
River carpsucker	0.6 (0.1)	0.1 (0.1)	0.0	4.4 (1.6)	3.6 (2.1)
Sauger	0.6 (0.4)	0.0	0.1 (0.1)	0.0	0.0
Shorthead redhorse	0.2 (0.4)	0.0	0.0	0.0	0.0
Smallmouth bass	0.8 (0.1)	4.6 (0.8)	2.5 (0.9)	1.4 (0.7)	3.4 (1.0)
Smallmouth buffalo	0.0	0.8 (0.4)	10.2 (6.7)	0.0	0.0
Spottail shiner*	34.6 (0.4)	11.9 (0.9)	18.3 (6.5)	13.9 (3.5)	4.9 (2.5)
Walleye	6.9 (10.6)	0.8 (0.3)	11.8 (5.2)	3.6 (1.8)	1.6 (0.7)
White bass	18.9 (3.1)	3.8 (0.6)	31.0 (17.5)	14.6 (5.0)	14.9 (9.2)
White crappie	0.0	0.0	0.9 (0.6)	2.1 (0.9)	0.4 (0.3)
White sucker	0.1 (0.1)	0.0	0.1 (0.1)	0.3 (0.2)	0.0
Yellow perch	21.6 (7.0)	4.7 (0.5)	121.0 (102.5)	6.4 (2.3)	10.9 (4.3)

*includes all ages

Table 5. Age distributions of walleyes collected from Lake Sharpe, South Dakota, with variable-mesh gill nets, 1997-2002, as determined from scales and the 2002 otoliths. Mean age excludes age-0 fish.

Year	Age													Mean
	0	1	2	3	4	5	6	7	8	9	10	11	12	
Scales														
1997	2	24	206	214	14	15	16	12	1	0	0	0	0	2.8
1998	3	22	42	234	147	23	19	14	7	0	0	0	0	3.5
1999	9	135	108	48	203	64	23	9	4	0	0	0	0	3.1
2000	12	61	270	57	78	74	22	7	2	2	0	0	0	2.9
2001	11	113	135	285	49	30	38	10	4	1	0	0	0	2.9
2002	1	58	135	148	137	48	20	18	8	4	0	0	0	3.2
Otoliths														
2002	1	57	153	140	141	29	4	19	23	1	2	5	0	3.0

Table 6. Mean back-calculated total lengths (mm) at annulus for each year class of walleye in Lake Sharpe gill-net catches, 2002, as determined from scales.

Year class	Age	N	Annulus 1	2	3	4	5	6	7	8	9
2001	1	50	199								
2000	2	101	181	289							
1999	3	127	173	263	343						
1998	4	120	182	273	338	391					
1997	5	46	189	279	343	390	429				
1996	6	20	194	273	341	395	430	455			
1995	7	17	196	289	351	406	441	465	483		
1994	8	7	189	274	342	397	443	472	496	513	
1993	9	4	185	260	313	367	414	460	489	519	537
All classes			187	275	339	391	431	463	490	516	537
N		492									

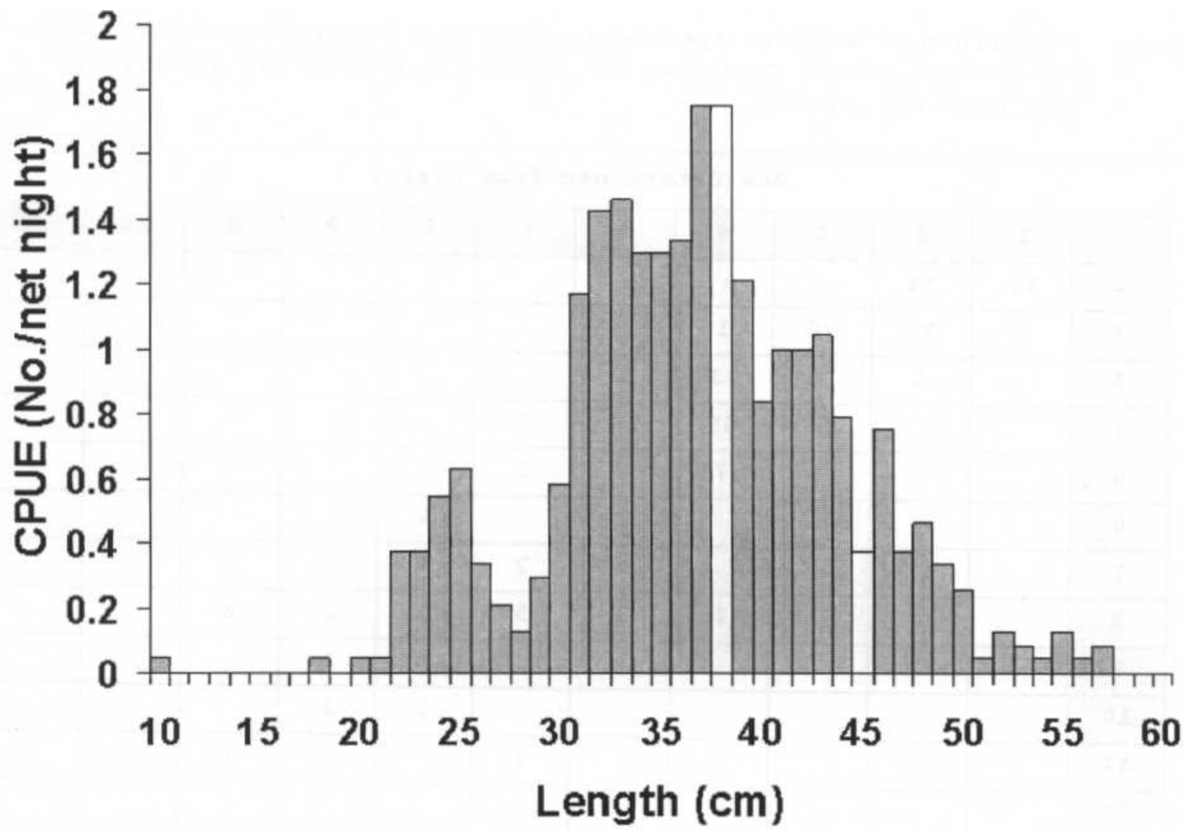

Figure 3. Length frequency of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, during August 2002.

Table 7. Average annual increments (mm) of back-calculated lengths at annulus for each year class of walleye in Lake Sharpe gill-net catches, 2002, as determined from scales.

Year class	Age	Growth period (ages)									
		N	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
2001		50	199								
2000		101	181	108							
1999		127	173	90	80						
1998		120	182	91	65	53					
1997		46	189	90	64	47	39				
1996		20	194	79	68	54	35	25			
1995		17	196	93	62	55	35	24	18		
1994		7	189	85	68	55	46	29	24	17	
1993		4	185	75	53	54	47	46	29	30	18
All classes N			187	88	64	52	40	32	27	26	21

Table 8. Comparison of walleye ages determined from interpretation of scale and otolith growth patterns for walleye collected in the August 2002 gill net sample.

Age determined from otholites		Age determined from scales										
		1	2	3	4	5	6	7	8	9	10	**11**
	1	41	14									
	2	2	75	20	1							
	3		6	75	13	2						
	4			6	65	10	2					
	5				7	6	2					
	6					1		1				
	7					2	2	5	1	1		
	8				1	3	5	3	2	2		
	9								1			
	10							1	1			
	11						2		1	1		
	12											
	13											
	14								1			

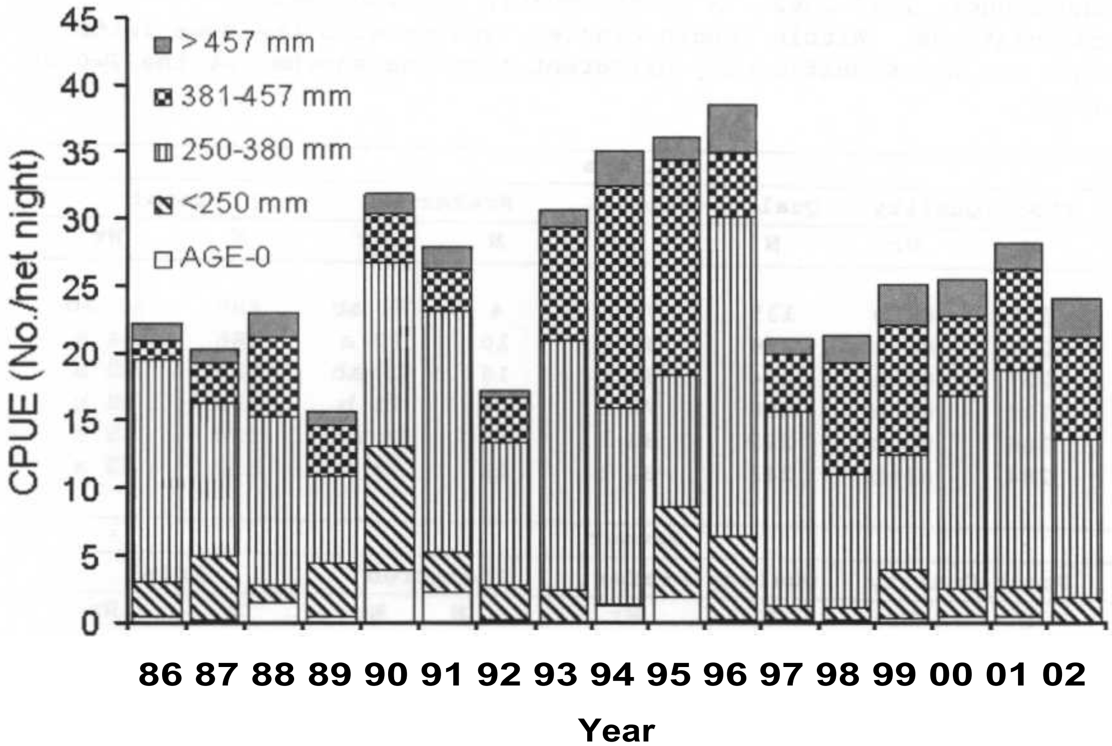

Figure 4. Size structure and abundance (CPUE) of walleye collected in the standard gill-net survey in Lake Sharpe, SD, during August, 1986-2002.

Walleye *Wr* values in Lake Sharpe in 2002 were within the range of values observed during the 1997-2002 period for all length categories (Table 9). Relative weight values for stock-to-quality-length walleyes collected in the 2002 gill net survey were significantly lower than for fish of the same length category in the 2001 survey, though still within the range observed during the 1997-2002 period.

The walleye survival rate estimate from catch-curve analysis of pooled 2001-2002 data was similar to other estimates except the estimate for 1999-2000 pooled data. The 1999-2000 pooled data estimate of survival may have been lower because of the inclusion of a strong 1998 year class in calculations (Table 10). Walleye population size structure, as indexed by PSD values, was within the balanced range of 40-60 (Table 11; Anderson 1978) and a balanced population is evident from examination of Figures 3 and 4. The peak on the walleye population length frequency histogram, at 250-mm (Figure 3), represents fish produced during 2001. The strength of the 2001 year class is not yet know because these fish have not fully recruited into the portion of the walleye population effectively sampled with gill nets. Based on otolith sample aging, the majority of the walleyes between 300- and 350-mm in length are from the 2000 year class and should not surpass the 381-mm minimum length limit until the fall of 2003.

Table 9. Mean relative weight (Wr), by length class, for Lake Sharpe walleye and sauger, 1997-2002. N is the number of fish used in calculations. Within length classes, values with the same letter code are not significantly different from one another at the P=0.05 level.

	Walleye							
Year	**Stock-Quality**		**Quality-Prefer.**		**Preferred**		**Total**	
	N	**Wr**	N	**Wr**	N	Wr	N	Wr
1997	337	82 b	139	79 c	4	76 ab	480	81 ab
1998	224	86 c	254	82 b	10	77 a	488	84 a
1999	207	84 a	294	81 b	18	76 ab	519	82 a
2000	324	82 b	188	78 d	18	71 b	530	80 b
2001	386	87 c	229	83 b	9	75 ab	624	85 a
2002	284	83ab	243	81 b	13	73 b	539	82 a

	Sauger							
Year	**Stock-Quality**		**Quality-Prefer.**		**Preferred**		**Total**	
	N	**Wr**	N	Wr	N	Wr	N	**Wr**
1997	0	----	38	79 b	34	77 a	72	78 b
1998	0	----	26	81 ab	51	79 a	77	80 a
1999	26	83 b	14	86 c	61	77 a	101	80 a
2000	26	86 b	83	82 a	52	72 b	161	79 a
2001	27	81 b	69	77 b	28	75 ab	124	77 b
2002	4	80 b	76	78 b	58	72 b	138	76 b

Table 10. Estimates of annual survival (S), annual mortality (A), and instantaneous mortality (Z) rates, from catch-curve analysis, for walleye in Lake Sharpe, South Dakota. Years indicate which annual gill-net surveys were combined for analysis and age structure data was determined from scale analysis.

Years	S	A	Z
1996-1997	0.45	0.55	0.81
1997-1998	0.48	0.52	0.73
1998-1999	0.45	0.55	0.79
1999-2000	0.37	0.63	1.00
2000-2001	0.48	0.52	0.73
2001-2002	0.49	0.51	0.71

Table 11. Walleye and sauger proportional stock density (PSD) and relative stock density (RSD-P and RSD-M) values for gill net samples, from 1997-2002, for Lake Sharpe, South Dakota.

Year	Walleye			Sauger		
	PSD	RSD-P	**RSD-M**	PSD	RSD-P	**RSD-M**
1997	30	1	0	100	47	1
1998	54	2	0	100	66	1
1999	60	3	0	75	61	2
2000	38	3	0	82	32	4
2001	38	1	0	78	23	2
2002	47	2	0	97	42	2

Walleye Recruitment Assessment

The mean 2002 nighttime electrofishing CPUE value of 12.6 walleye/h was the lowest of the 1995-2002 period, though not significantly different from values for 1996, 1999, and 2001, at the p=0.05 level of significance (Table 12). Mean CPUE values for 1995, 1997, 1998, and 2000 were all significantly higher than the 2002 value. Mean length of age-0 walleye captured during fall electrofishing in 2002, at 147 mm, was similar to values for 1997, 1998, and 2000 (Table 12). Patterns in 2002 fall nighttime walleye electrofishing CPUE were similar to those observed during the 1999-2001 period, with mean CPUE values being highest in the upper portion of Lake Sharpe, specifically at Hipple Lake and the inside of LaFramboise Island.

Table 12. Mean nighttime electrofishing catch per unit effort (CPUE; No./h) and length (mm) for age-0 walleye collected during September 1995-2002 on Lake Sharpe, SD. S.E. denotes standard error values about means and N is sample size.

Year	Catch per Unit Effort (No./h)			Mean length (mm)		
	N	CPUE	**S.E.**	**N**	**Length**	S.E.
1995*	18	59.6	11.6	268	175	1.2
1996	18	22.4	3.4	101	136	2.9
1997*	18	42.7	9.7	197	142	1.6
1998#	22	42.2	10.4	236	146	1.2
1999'	36	20.1	2.9	181	130	1.3
2000'	36	75.1	8.6	522	147	0.7
2001'	36	22.9	4.1	321	164	1.1
2002'	36	12.6	2.6	113	147	1.6

* North Shore, Joe Creek and Farm Island
\# North Shore, Joe Creek, Farm Island and Degrey
\+ North Shore, Joe Creek, Farm Island, Degrey, LaFram. Bay and stilling basin

Potential early indicators of walleye year class strength were compared to mean age-1 gill net CPUE to determine which indicators or surveys were the best early indicators of walleye recruitment. Potential indicators of walleye recruitment and values for the 1994-2002 period are listed in Table 13. Summer age-0 seining CPUE and fall age-0 walleye electrofishing CPUE, for the 1995-2002 period, were not significantly correlated with CPUE of age-1 walleye in the standard gill net survey the next year ($P = 0.38$, $r = 0.36$, d.f.=7 and $P = 0.13$, $r = 0.63$, d.f.= 6, respectively). However, walleye age-0 gill net CPUE was significantly positively correlated with walleye age-1 gill net CPUE the next year ($P=0.01$, $r = 0.83$, d.f.=7).

Length of age-0 walleye during August, when the standard gill net survey is conducted, varies greatly among years and may affect gill netting efficiency for age-0 walleye (Hamely 1975). Therefore multiple correlation analyses were conducted using age-0 seining or nighttime electrofishing and mean length of age-0 walleye in the fall nighttime electrofishing survey (as an index of gill netting efficiency) as independent variables and age-0 gill net CPUE as the dependent variable. Though not significant at the $P = 0.05$ level, more of the variation in age-0 gill net CPUE was explained by adding mean length of age-0 walleye in the nighttime electrofishing survey to either seining or nighttime electrofishing CPUE of age-0 walleye ($P = 0.07$, $r = 0.81$, d.f.=7 and $P = 0.17$, $r = 0.76$, d.f.=7, respectively) than simply comparing age-0 gill net CPUE with either age-0 walleye seining or nighttime electrofishing CPUE in linear regression analyses. Therefore, conducting the seining and fall nighttime electrofishing surveys for age-0 walleye may help determine the presence of an initially strong walleye year class, when a low mean length of age-0 walleye in August results in low gill netting efficiency of age-0 walleye.

Table 13. Mean age-0 walleye seine haul catch-per-unit-effort (CPUE; No./haul), mean standard gill net age-0 walleye CPUE (No./net night), mean age-0 walleye nighttime electrofishing CPUE (No./h), and mean standard gill net age-1 walleye CPUE (No./ net night) for the 1994-2002 walleye year classes, in Lake Sharpe, SD.

Year Class	Seine Age-0 CPUE	Gill net Age-0 CPUE	Electrofishing Age-0 CPUE	Gill net Age-1 CPUE
1994	5.9	1.50	------	2.96
1995	2.5	1.63	59.6	7.89
1996	2.2	0.11	22.4	1.00
1997	1.1	0.08	42.7	0.92
1998	6.9	0.13	42.2	5.63
1999	0.8	0.38	20.1	2.65
2000	11.8	0.52	75.1	4.71
2001	3.6	0.46	22.9	2.42
2002	1.6	0.04	12.6	-----

Population Parameters for Sauger

Seven year classes of sauger were collected with gill nets in Lake Sharpe in 2002 (Table 14). Lengths of sauger collected in the August gill-net survey ranged from 228 to 545 mm TL (Figure 5). Age-2 sauger (2000 year class) comprised 40% of the catch in 2002, as determined from age interpretation of scale samples. Age-3 and age-4 sauger (1999 and 1998 year classes) comprised 21% and 25% of the sauger gill net catch in 2002 (Table 14). Sauger *Wr* values in 2002, for all incremental length groups, were similar to 2001 values (Table 9). Proportional stock density and RSD-P values for the 2002 sauger gill net sample, at 97 and 42, respectively, were higher than corresponding values for 2001 (Table 11). Increases in PSD and RSD-P values for sauger from 2001 to 2002 were due to the growth of fish in the 2000 year class past quality length and the growth of fish in the 1999 year class past preferred length (Table 15). Sauger CPUE in the August 2002 gill net survey was similar to 2001 and within the range of values for the 1998-2002 period (Table 3). Estimated total mortality for the 2001-2002 gill net survey, pooled age-frequency data, was calculated at 65%, using age-3 through age-6 fish.

Table 14. Age distributions of sauger collected from Lake Sharpe, South Dakota, with variable-mesh gill nets, 1997-2002. Mean age excludes age-0 fish and age structure was determined from scale analysis.

	Age								
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Mean**
1997	0	0	8	45	15	4	0	0	3.2
1998	0	0	1	31	39	5	1	0	3.7
1999	0	26	13	11	35	16	0	0	3.0
2000	0	7	100	15	12	28	1	0	2.7
2001	0	20	25	73	2	4	1	0	2.6
2002	0	1	54	32	37	10	2	2	3.1

Table 15. Mean back-calculated total lengths (mm) at annulus for each year class of sauger in Lake Sharpe gill net catches, 2002, as determined from **scales**.

Year class	**Age**	N	**Annulus**						
			1	**2**	**3**	**4**	**5**	**6**	**7**
2001	1	1	176						
2000	2	93	187	306					
1999	3	52	184	274	347				
1998	4	61	194	298	348	390			
1997	5	11	206	321	376	406	427		
1996	6	2	215	300	366	411	467	514	
1995	7	2	201	302	349	388	435	472	507
All Classes			195	300	357	399	443	493	507
N		222							

Table 16. Average annual increments (mm) of back-calculated lengths at annulus for each year class of sauger in Lake Sharpe gill-net catches, 2002, as determined from scales.

Year class	Age	N	Growth period (ages)						
			0-1	1-2	2-3	3-4	4-5	5-6	6-7
2001	1	1	176						
2000	2	93	187	119					
1999	3	52	184	90	73				
1998	4	61	194	104	50	42			
1997	5	11	206	115	55	30	21		
1996	6	2	215	85	66	45	56	47	
1995	7	2	201	101	47	39	47	37	35
All Classes			195	105	57	42	44	50	14
N									

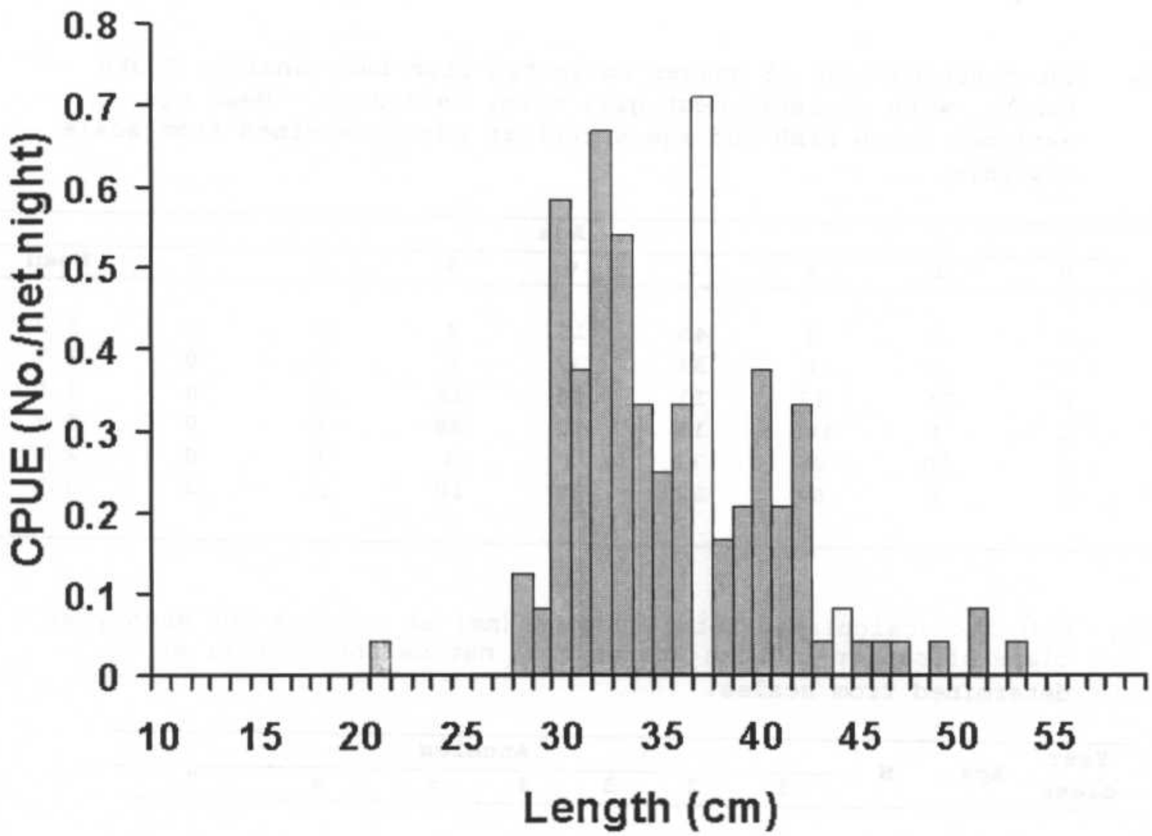

Figure 5. Length frequency of sauger collected during the standard gill-net survey during August 2002, on Lake Sharpe, South Dakota.

Population Parameters for Smallmouth Bass

Beginning in 2002, one rip-rap (Bid Bend Dam) and one natural reservoir habitat area (Joe Creek) have each sampled weekly for three weeks during late-May and early-June, by nighttime electrofishing. Data collected during 1993, 1994, and 2001 is included for comparison with 2002 data (Table 17). During 2001 and 2002, CPUE values were significantly higher at Big Bend Dam than Joe Creek (Table 17). However, PSD and RSD-P values were lower for Big Bend Dam samples than Joe Creek samples. This pattern of higher catch rates and lower stock density indices values for rip-rap sampling areas was also documented for Lake Oahe (Lott 1996, Lott 2000).

A total of 280 smallmouth bass were aged from spring electrofishing samples and a joint tagging effort by the South Dakota BASS Federation and Game, Fish and Parks during June of 2002. Mean back-calculated length at annulus values for this sample of Lake Sharpe smallmouth bass were higher than the statewide mean values and similar to Missouri River reservoir mean values (Willis et al. 2001) for age-1 through age-4 fish (Table 18). Mean back-calculated length at age 4 for the Lake Sharpe smallmouth bass sample was 303 mm, as compared to 277 mm for the statewide mean and 299 mm for the Missouri River reservoir mean (Willis et al. 2001). Mean back-calculated length at age-5 for the 2002 Lake Sharpe sample, at 352 mm, was significantly higher than both the statewide and Missouri River reservoir mean values of 333 mm and 337 mm, respectively.

Table 17. Mean smallmouth bass electrofishing catch-per-unit effort (CPUE; No./h) and stock density indices values for spring, nighttime electrofishing samples at Joe Creek and Big Bend Dam.

Location	**Year**	**N**	**CPUE**	SE	**Ns**	**PSD**	**RSD-P**	RSD-M
Joe Creek	2001	6	16.7	6.9	56	91	54	7
	2002	18	12.4	2.1	24	88	25	4
Big Bend Dam	1993	12	52.0	14.3	75	21	1	0
	1994	12	47.0	17.3	64	38	11	3
	2001	9	42.2	17.2	75	39	8	0
	2002	18	51.1	16.3	208	46	11	0

Table 18. Mean back-calculated total lengths (mm) at annulus and length increments for each year class of smallmouth bass collected from Lake Sharpe by nighttime electrofishing and angling, 2002, as determined from scales.

Year class	Age	N	Annulus 1	2	3	4	5	6	7	8
2001	1	19	110							
2000	2	18	113	183						
1999	3	55	110	182	257					
1998	4	97	116	190	260	313				
1997	5	59	111	172	239	303	348			
1996	6	17	108	181	249	320	367	399		
1995	7	11	109	170	228	289	351	392	423	
1994	8	4	122	182	242	287	344	383	411	433
Total/mean		280	112	180	246	303	352	391	417	433
Standard error			2	3	5	6	5	5	6	0
Length increment			68	66	57	50	39	26	16	

Smallmouth bass mean *Wr* values for the 2002 electrofishing sample, for all incremental length groups, were higher than in 2001 (Table 19). As for the 2001 sample, mean *Wr* values for the 2002 sample decreased steadily with increasing length, from a value of 111 for sub-stock-length fish to a value of 86 for memorable-trophy-length fish (Table 19). Smallmouth bass included in the samples for which *Wr* values were calculated were collected during May and June 2001 or 2002. Relative weight values for larger fish may have been lower due to spawning season behavior, a high representation of males in electrofishing samples, and the possibility that many of the female weights recorded were post-spawn weights.

Table 19. Mean relative weight (Wr), by length class, for Lake Sharpe smallmouth bass collected by electrofishing and angling during May and June of 2001 and 2002. N is the number of fish used in calculations. Values with the same letter code, within a year, are not significantly different from one another at the P=0.05 level.

Year	Sub-stock		Stock-to-Quality		Quality-to-Preferred		Preferred-to Memorable		Memorable-to-Trophy	
	N	Wr	N	Wr	N	Wr	N	Wr	N	Wr
2001	11	98a	31	96a	61	93b	110	87c	24	78d
2002	2	111a	26	102b	70	98c	68	96d	7	86e

Smallmouth Bass Tagging and Exploitation

A total of 304 smallmouth bass captured by nighttime electrofishing or angling from May 17 through June 16, 2002 were tagged with T-bar anchor tags. Only smallmouth bass ?200 mm TL were tagged. Twenty-two percent of smallmouth bass tagged were reported as caught by anglers between May and

December 2002 (Table 20). However, of the 22% reported by anglers, 67% were harvested. Percent of tagged fish caught that were harvested exceeded 65% for smallmouth bass between 250 mm and 399 mm in length, with a lower percent harvested for smallmouth bass 400-mm and longer. One rationale for the difference in harvest/release percentages among lengths of smallmouth bass is that anglers begin keeping smallmouth bass at a length of about 300 mm and bass >400 mm in length are rarely caught by anglers except those specifically targeting smallmouth bass. Anglers specifically targeting smallmouth bass may be more release-oriented in their harvest approach then anglers fishing for walleye or for anything. Patterns in percentages of tagged smallmouth bass caught per month mirror estimates of fishing pressure with the majority of smallmouth bass being caught in June, just a few days or weeks after tagging (Table 20).

Table 20. Smallmouth bass tagging and reporting statistics, by month and tagging location, for fish tagged during May and June 2002, on Lake Sharpe, South Dakota.

Length group (mm)	Number				Percent caught	Percent of those caught	
	Tagged	Caught	Kept	Released		Kept	Released
200-249	3	0	0	0	0		
250-299	31	3	2	1	10	67	33
300-349	129	35	24	11	27	69	31
350-399	110	19	14	5	17	74	26
400-449	25	9	4	5	36	44	56
450-499	6	0	0	0	0		
Total	**304**	**66**	**44**	**22**	**22**	67	**33**

Month	Number			Percent of total caught	Percent of those caught	
	Caught	Kept	Released		Kept	Released
May	4	2	2	6	50	50
June	47	31	16	71	66	34
July	10	7	3	15	70	30
August	0	0	0	0		
Sept.	5	4	1	8	80	20
Oct.	0	0	0	0		
Nov.	0	0	0	0		
Dec.	0	0	0	0		
Total	**66**	**44**	**22**	**100**	**67**	**33**

* Not all tagged smallmouth bass were available for angler capture during May and until June 16, 2002.

Beginning January 1, 2003, a 306- to 457-mm protected slot length limit regulation will be in effect for smallmouth bass on Lake Sharpe. In addition to the protected slot, anglers will be allowed at most one smallmouth bass equal to or longer than 457-mm as part of the five-fish daily limit. Data on smallmouth bass growth, condition, and exploitation will be used along with other population survey data (age-0 seining CPUE) and angler use, harvest and preference data, to determine the effects of regulations implemented in 2003.

RESERVOIR-WIDE ANGLER USE AND HARVEST SURVEY

Fishing Pressure

Anglers fished an estimated 385,357 hours (89,827 angler days) on Lake Sharpe during daylight hours of April-September, 2002 (Table 21). These values are substantially higher than values for angler hours and angler days for the April-September periods of 2000 and 2001, similar to values for 1999 and within the range previously estimated for Lake Sharpe (Table 21). Though the 2002 estimate of 89,827 angler days was below the Lake Sharpe Strategic Plan objective of 100,000 angler days, the estimated walleye harvest exceeded the walleye harvest objective of 100,000 fish by 44%. Peak fishing pressure in 2002 occurred in June at an estimated 99,769 hours (Table 22). The lower zone of Lake Sharpe received 47% of the fishing pressure, followed by the upper zone with 29% and the middle zone supported 24% of the total fishing pressure for the April-September 2002 daylight period.

Table 21. Angler use and harvest estimates from surveys conducted during daylight hours, April-September on Lake Sharpe, South Dakota.

Year	Fishing pressure (h)	Angler trips	Fish harvest (No.)	Walleye harvest (No.)	Reference
1973-1974	208,800	46,400	76,813	62,479	Schmidt (1975)
1984	241,986	52,605	87,020	64,784	Riis (1986)
1985	274,376	62,358	123,942	66,584	Riis (1986)
1991	303,381	70,554	143,307	93,027	Fielder et al. (1992)
1992	402,543	100,636	219,152	157,220	Stone et al. (1993)
1993	291,970	60,827	102,833	83,133	Stone et al. (1993)
1994	347,125	91,752	152,981	130,009	Riis & Johnson (1995)
1995	356,391	122,893	166,949	140,943	Riis et al. (1996)
1996	477,220	101,536	170,568	142,506	Riis et al. (1997)
1997	442,827	100,097	191,079	159,274	Johnson et al. (1998)
1998	502,631	111,696	252,496	207,144	Johnson et al. (1999)
1999	386,315	84,784	186,720	155,724	Johnson and Lott 2000
2000	325,532	71,893	144,730	104,076	Johnson and Lott 2001
2001	300,078	77,141	126,382	95,044	Johnson et al. 2002
2002	385,357	89,827	210,781	144,065	This study

Estimated fishing pressure, for the April-September daylight period of 2002, averaged 16.0 angler-h/ha (Table 23) and was 24% lower than the Lake Sharpe record pressure estimate for 1998. Estimated angler hours for shore anglers has decreased from 72,782 h in 1997 to 32,109 h in 2002 (Table 23).

Table 22. Estimated total fishing pressure (angler hours), by month and zone, on Lake Sharpe, South Dakota, 2002.

Zone	Month						Total
	April	May	June	July	August	Sept.	
Upper	15,526	26,997	17,784	20,878	14,097	18,106	113,388
95% CI	7,305	12,359	8,478	19,445	5,110	10,812	28,268
Middle	1,557	22,683	12,077	7,858	17,563	28,331	91,401
95% CI	3,052	13,067	8,123	5,090	9,391	13,701	23,406
Lower	4,852	27,914	69,908	29,454	25,420	23,021	180,568
95% CI	6,704	21,390	19,985	14,952	11,161	16,101	38,849
Total	23,266	77,594	99,769	58,189	57,081	69,458	385,357
95% CI	10,374	27,947	23,179	25,052	15,455	23,746	53,444

Table 23. Estimated total angler hours, for boat and shore fishing and methods combined, for Lake Sharpe, South Dakota, April-September, 1997-2002.

Year	Boat		Shore		Combined	
	Total angler hours	No. h/ha	Total angler hours	No. h/ha	Total angler hours	No. h/ha
1997	370,045	15.6	72,782	3.1	442,827	18.7
1998	438,303	18.5	64,328	2.7	502,631	21.2
1999	345,601	14.6	40,714	1.7	386,315	16.3
2000	295,639	12.5	29,893	1.3	325,532	13.8
2001	266,857	11.3	33,221	1.4	300,078	12.7
2002	353,248	14.7	32,109	1.3	385,357	16.0

Fish Harvest

Anglers fishing Lake Sharpe harvested an estimated 210,781 fish during the daylight hours of April-September, 2002 (Table 24, Figure 6). This estimated harvest is 17% lower than the estimated 252,496 fish harvested during the same period in 1998 (Table 21). The estimated walleye harvest for the April-

September 2001 daylight period, at 144,065 walleye, surpassed the Lake Sharpe Strategic Plan sustainable harvest objectives of 100,000 walleye by over 44,000 fish but was 30% lower than the record harvest estimate of 207,144 walleye, for 1998. Estimated harvest by species and month is presented in Table 24. Estimated number of fish caught and released is presented in Table 25. Walleye compromised 65% of the total fish caught, 68% of the total estimated harvest and 63% of the total number of fish released during the April - September 2002-daylight survey period.

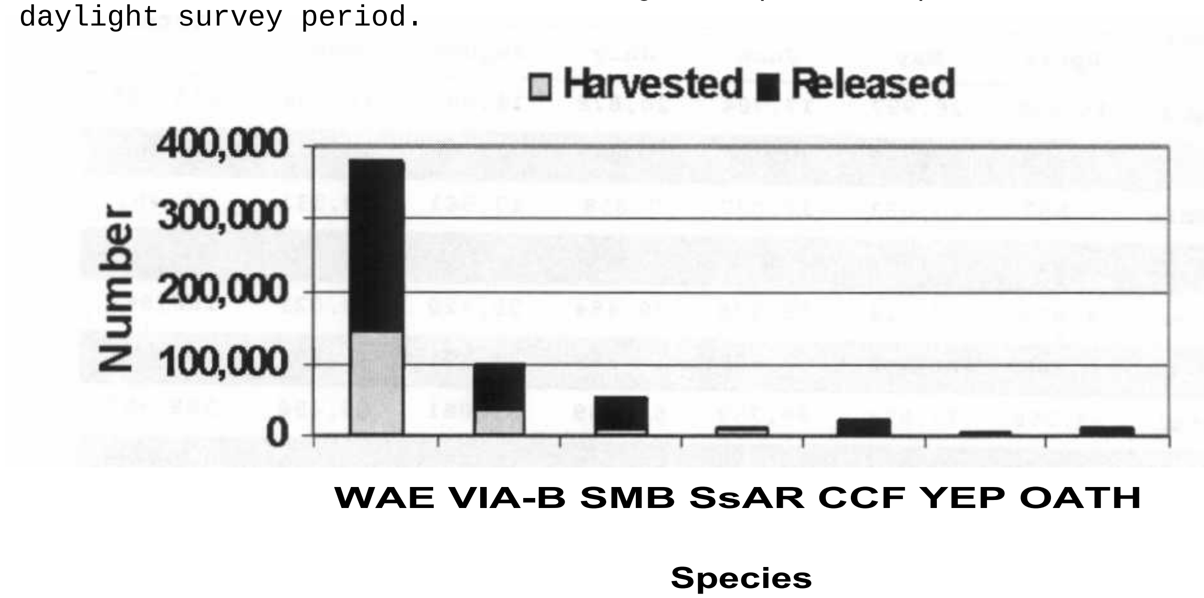

Figure 6. Estimated sport-fish harvest in Lake Sharpe, South Dakota, during April-September, 2002 (584,735 fish caught).

White bass were second in terms of angler catch and harvest during the April-September 2002 daylight period (Tables 24, 25 and Figure 6) . An estimated 35,993 white bass were harvested and an estimated 64,278 white bass were released during the April-September 2002 survey period. Smallmouth bass were third in terms of angler catch and harvest with an estimated 11,696 smallmouth bass harvested and 40,358 released. As with walleye harvest and fishing pressure, smallmouth bass catch and harvest peaked in June, while white bass catch and harvest peaked in May (Tables 24 and 25).

Estimated fish harvest varied greatly among zones and species (Table 26) because of species-specific habitat preferences and fishing pressure patterns among zones. Walleye and channel catfish were common in angler catches throughout the reservoir and patterns in harvest by zone were similar to fishing pressure patterns. Sauger were more prevalent in the harvest in upper and middle Lake Sharpe's more-riverine habitat. Rainbow trout were harvested exclusively in upper Lake Sharpe during 2002, due to the cold water discharged from Oahe Dam and annual stockings in the marina basin near the Oahe Dam tailrace. White bass harvest was higher in upper and middle Lake Sharpe while, yellow perch and smallmouth bass harvest were highest in lower Lake Sharpe.

The percentage of angling parties harvesting a limit of walleye in 2002 (Table 27), at 18%, was similar to the five-year average of 20%. A lower percentage of angling parties (33%) did not harvest a walleye during their fishing trip to Lake Sharpe in 2002 versus 2001 (44%). However, the percentage of angling parties not harvesting walleye during 2002 was similar to the five-year average of 33%. The percentage of angling parties harvesting a four- walleye limit is strongly affected by the size distribution of walleye in the angler catch and hourly catch rates of walleye by anglers. When asked what species they fished for in Lake Sharpe, in 2002, 80% of angling parties said they were fishing for walleye, while 17% said they were fishing for anything (Table 28).

Table 24. Total estimated fish harvest, by month, for anglers fishing Lake Sharpe, South Dakota, 2002. Species abbreviations used appear in Appendix 1.

Species	Month						
	April	May	June	July	August	Sept.	Total
WAE	4,592	24,093	33,500	35,178	27,518	19,183	144,065
95%CI	688	10,030	6,694	11,991	5,727	16,892	24,728
SAR	0	3,497	3,778	890	138	0	8,303
95%CI	0	960	504	32	37	0	1,085
WHB	0	16,953	13,333	1,509	1,975	2,223	35,993
95%CI	0	8,684	5,504	809	449	275	10,327
SMB	33	2,312	4,602	2,728	1,079	942	11,696
95%CI	--	1,982	901	1,377	615	527	2,701
CCF	355	1,081	1,081	1,509	1,755	38	5,820
95%CI	380	784	769	844	734	64	1,614
RBT	-	795	0	0	23	0	818
95%CI	-	-	0	0	0	0	-
YEP	0	120	357	505	200	146	1,326
95%CI	0	-	260	351	88	155	472
OTH	1	1,939	406	140	61	213	2,760
95%CI	-	-	-	-	-	-	-
TOTAL	4,981	50,790	57,057	42,459	32,749	22,745	210,781
95%CI	860	17,457	10,786	14,107	6286	16,989	30,805

Other (OTH) includes black crappie, bluegill, common carp, freshwater drum, goldeye, largemouth bass, white crappie, northern pike, and chinook salmon.

Table 25. Total estimates of fish released, by month, for anglers fishing Lake Sharpe, South Dakota, April-September, 2002. Species abbreviations used appear in Appendix 1.

	Month						
Species	**April**	**May**	**June**	**July**	**August**	Sept.	**Total**
WAE	1,411	24,798	116,603	41,780	21,063	30,232	235,887
SAR	0	653	3,041	174	0	0	3,868
WHB	0	9,474	22,087	11,237	11,047	10,433	64,278
SMB	544	4,031	18,629	6,193	2,525	8,435	40,358
CCF	0	3,359	2,044	4,676	5,554	1,144	16,777
RBT	0	955	0	0	0	73	1,029
YEP	0	74	1,554	485	2,553	336	5001
OTH	0	2,829	1,218	797	1,442	472	6,756
TOTAL	1,955	46,173	165,176	65,342	44,184	51,125	373,954

Other (OTH) includes black crappie, bluegill, common carp, freshwater drum, goldeye, largemouth bass, white crappie, northern pike, and chinook salmon.

Table 26. Total estimated fish harvest, by zone, from Lake Sharpe, South Dakota, during April-September, 2002.

	Zone			
Species	**Upper**	**Middle**	**Lower**	**Total**
Walleye	44,836	23,766	75,463	144,065
Sauger	2,976	3,386	1,941	8,303
White bass	18,932	16,076	985	35,993
Smallmouth bass	895	74	10,728	11,696
Channel catfish	2,866	1,394	1,570	5,820
Rainbow trout	818	0	0	818
Yellow perch	130	74	1,123	1,326
Other	793	1,778	177	2,760
Total	**72,246**	**46,548**	**91,987**	**210,781**

Table 27. Percent of angling parties that harvested a limit of walleye, at least three walleye/angler, at least two walleye/angler, etc. from Lake Sharpe, South Dakota, 1997-2002.

Party success (walleye/angler)	**Year**					
	1997	**1998**	**1999**	**2000**	**2001**	**2002**
Limit (4)	17	26	27	18	12	18
3.0 - 3.9	8	10	12	9	8	12
2.0 - 2.9	9	10	12	12	7	12
1.0 - 1.9	13	13	14	16	15	15
0.1 - 0.9	9	10	8	12	13	10
0	44	31	27	32	44	33

Table 28. Percent of anglers fishing for specified target species, in Lake Sharpe, South Dakota, 1997-2002.

Target Species	**Percent by year**					
	1997	**1998**	**1999**	**2000**	**2001**	**2002**
Walleye	82	80	86	78	75	80
Anything	11	15	11	19	18	17
Rainbow Trout	1	2	1	*	4	1
White Bass	2	2	*	1	1	1
Smallmouth bass	*	*	*	1	1	1
Other*	4	1	2	1	1	

* Values >0.5 percent, included with other.

Catch, Harvest and Release Rates

The mean harvest rate (species, zones, and types of fishing combined), for the April-September 2002 daylight period, was 0.55 fish/angler-h (Table 29). Mean hourly catch rates of all species combined, by anglers, peaked in June at 2.23 fish/h and mean values were above 1.0 fish/angler-h from May through September (Table 30). The mean catch rate for walleye, for the April-September 2002 daylight period, was 0.99 walleye/angler-h, a value substantially greater than the 0.3 walleye/angler-h value considered to be an excellent hourly catch rate (Colby et al 1979). Mean hourly walleye catch rates by anglers followed a typical Lake Sharpe pattern, peaking in June (Table 31). The highest mean hourly walleye release rate by anglers occurred during June in 2002 when anglers released approximately 74% of the walleye caught (Table 31). High release rates during 2002 were a result of the 381-mm minimum length limit and abundant 1999- and 2000-year classes that had not grown to a legal harvest length by June 2002.

Table 29. Harvest rate, release rate, and catch rate, by species, for anglers fishing Lake Sharpe, South Dakota, during the daylight hours of April-September, 2002. Trace (T) indicates values >0.0 but <0.005.

Species	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)	Catch rate (fish/angler-h)
Walleye	0.37	0.61	0.99
Sauger	0.02	0.01	0.03
White bass	0.09	0.17	0.26
Smallmouth bass	0.03	0.10	0.14
Channel catfish	0.02	0.04	0.06
Rainbow trout	T	T	T
Yellow perch	T	0.01	0.02
Other	0.02	0.03	0.02
Species combined	**0.55**	**0.97**	**1.52**

Lengths of Fish Harvested

Frequency histograms of lengths of walleye harvested during 2002 (Figure 7) illustrate the effects of the 381-mm minimum length limit, in effect during all months of the year except July and August. The peaks in length frequency histograms from 380-400-mm in length correspond to the 1998-year class. During May and June 2002, when the 381-mm minimum length limit was in effect, anglers were required to release all walleye <381-mm in length caught, resulting in high release rates (Table 31). However, during July and August, when no minimum length limit was in effect, anglers routinely harvested walleye between 300 and 381-mm in length (Figure 7).

Length frequencies of harvested Lake Sharpe smallmouth bass illustrate a typical pattern Lake Sharpe pattern in length at harvest, with the median length of bass harvested at approximately 350 mm (Figure 8). The wide range in lengths of smallmouth bass harvested by anglers from Lake Sharpe in 2002 is likely the result of measurable smallmouth bass recruitment from 1994-2002. The majority of angler-caught smallmouth bass are from the 1994-1997 year classes. The majority of the fish in these year classes will be protected from harvest by the 305-457-mm protected-slot length limit being implemented in 2003.

Table 30. Harvest rate, release rate and catch rate for all species by month, for anglers fishing Lake Sharpe, South Dakota, during the daylight hours of April-September, 2002.

Month	**Harvest rate (fish/angler-h)**	**Release rate (fish/angler-h)**	**Catch rate (fish/angler-h)**
April	0.21	0.08	0.30
May	0.65	0.60	1.25
June	0.57	1.66	2.23
July	0.73	1.12	1.85
August	0.57	0.77	1.35
September	0.33	0.74	1.06
Overall	**0.55**	**0.97**	**1.52**

Table 31. Harvest rate, release rate and catch rate of walleye, by month, for anglers fishing Lake Sharpe, South Dakota, during daylight hours, 2002.

Month	**Harvest rate (fish/angler-h)**	**Release rate (fish/angler-h)**	**Catch rate (fish/angler-h)**
April	0.20	0.06	0.26
May	0.31	0.32	0.63
June	0.34	1.17	1.50
July	0.60	0.72	1.32
August	0.48	0.37	0.85
September	0.28	0.44	0.72
Overall	**0.37**	**0.61**	**0.99**

Angler Demographics and Economics

The majority of resident anglers fishing Lake Sharpe during the April-September 2002 daytime period were from Hughes (36%), Minnehaha (13%), Beadle (9%), Stanley (8%), and Pennington (6%) counties (Figure 9). Non-residents comprised 28% of angler contacts on Lake Sharpe, during the April-September 2002 daylight period. This percentage is similar to values observed from 1997-2001 (Johnson et al. 1998, Johnson and Lott 1999, Johnson and Lott 2000, Johnson and Lott 2001, Johnson et al. 2002). Percentages of non-resident anglers from the various states listed in Table 32 were within the ranges observed in previous years. Minnesota anglers comprised a lower percentage of total non-resident contacts in 2002 than in 2001 (Table 32). Patterns in distances anglers traveled, one way, to fish Lake Sharpe, during the April-September 2001 daylight survey period, differed from 2001, with a lower percentage of angler trips during April-September 2002 (27%) by anglers traveling <25 miles one way to fish Lake Sharpe (Table 33) . Approximately 58% of angler parties fishing Lake Sharpe traveled over 100 miles, one way, to fish the reservoir in 2002.

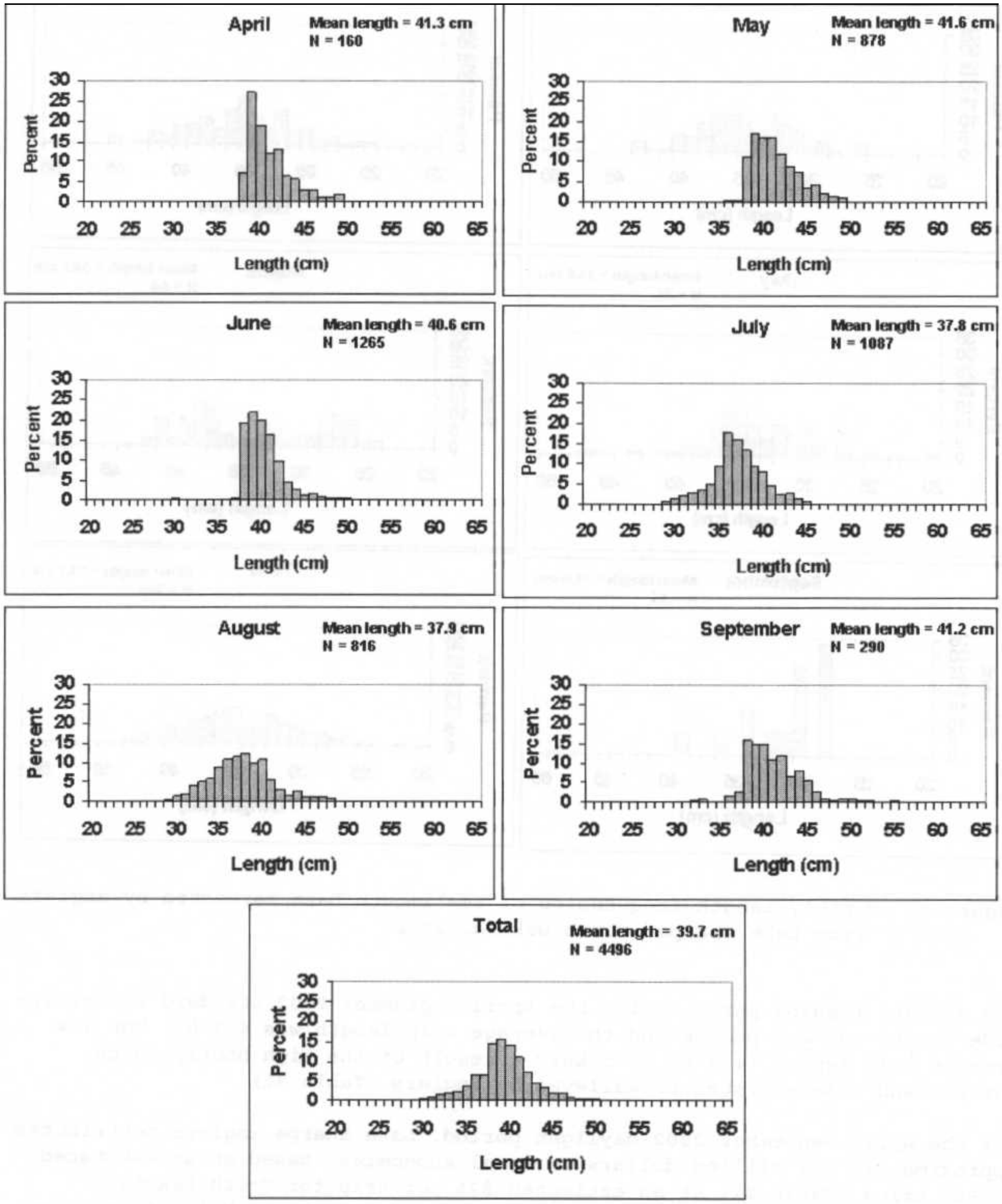

Figure 7. Monthly length frequencies of walleye harvested by anglers from Lake Sharpe, South Dakota, 2002.

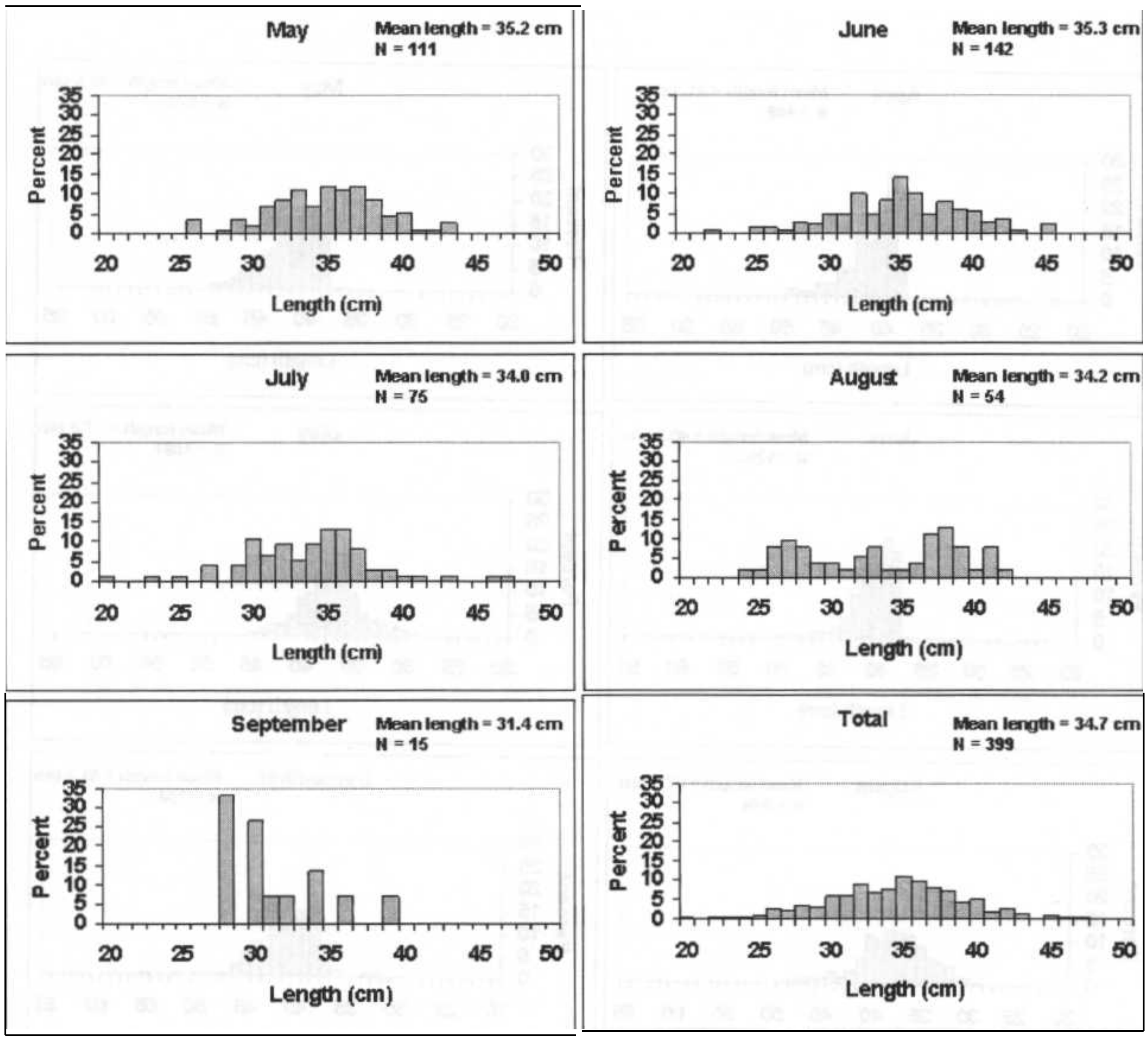

Figure 8. Monthly length frequencies of smallmouth bass harvested by anglers from Lake Sharpe, South Dakota, 2002.

The average fishing party during the April-September 2002 standard reservoir-wide survey was 2.2 people and the average trip length was 4.3 h. The low average trip length (4.3 h) is likely a result of the high hourly catch, harvest and release rates of walleyes by anglers (Table 31).

For the April-September 2002 daylight period, Lake Sharpe anglers contributed approximately 6.7 million dollars to local economies, based on an estimated 89,827 trips (Table 21) at an estimated $75 per trip for South Dakota's Missouri River reservoirs (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 1997).

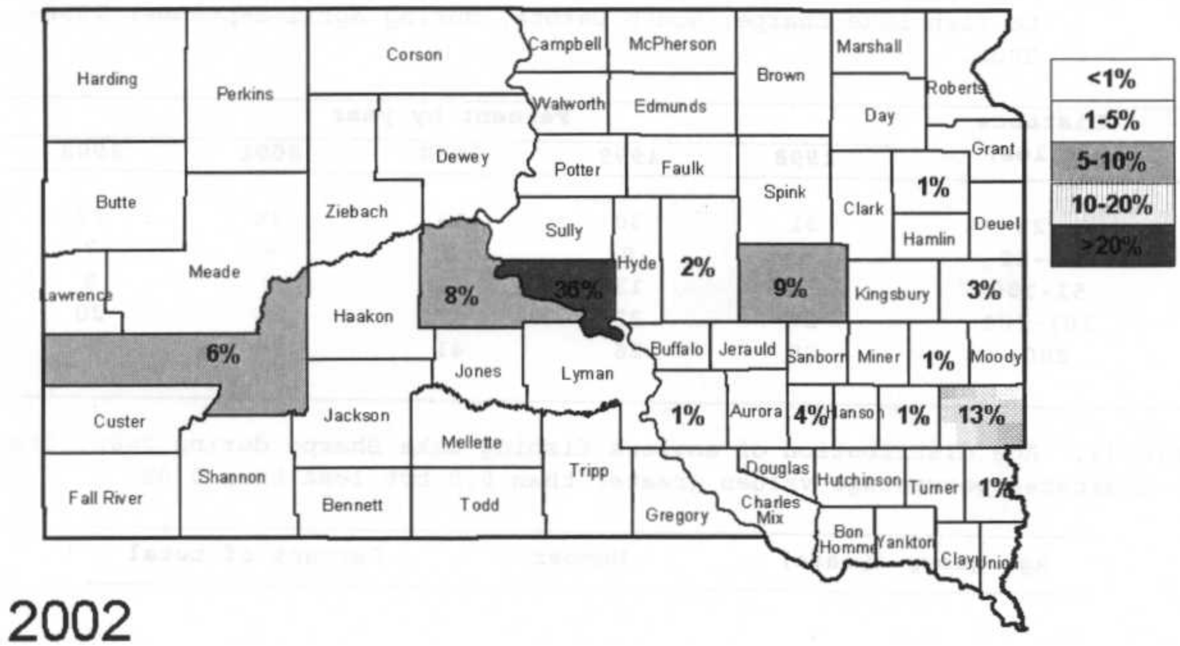

Figure 9. County of residence for resident anglers fishing Lake Sharpe during the April-September 2002 daytime period.

Anglers were asked their age as part of the 2002 angler use, harvest, and preference survey on Lake Sharpe. Only 15% of anglers fishing Lake Sharpe during the April-September 2002 daytime period were less than 20 years old (Table 34). Anglers between age 35 and 54 comprised 54% of anglers fishing Lake Sharpe in 2002.

Table 32. Percent of total non-resident angler contacts from various states, fishing Lake Sharpe, South Dakota, 1998-2002.

State	Percent by year				
	1998	1999	2000	2001	2002
Iowa	38	29	33	32	35
Nebraska	22	30	18	21	24
Minnesota	23	22	16	26	17
Colorado	3	4	8	4	4
Wisconsin	1	3	3	4	3
Wyoming	2	2	2	1	2
Others*	6	5	20	12	15

* Alaska, Arizona, Arkansas, California, Florida, Illinois, Indiana, Kansas, Missouri, Montana, Nevada, New Hampshire, New Jersey, New York, North Dakota, Oklahoma, Pennsylvania, Texas, Vermont, and Virginia.

Table 33. Percentages of anglers traveling the specified distances, one way, to fish Lake Sharpe, South Dakota, during April-September 1998-2002.

Distance	**Percent by year**				
(miles)	**1998**	**1999**	**2000**	**2001**	**2002**
<25	31	30	23	38	27
25-50	6	8	8	4	7
51-100	11	13	11	8	8
101-200	27	22	17	24	20
200+	25	26	41	26	38

Table 34. Age distribution of anglers fishing Lake Sharpe during 2002. Trace (T) indicates percentage values greater than 0.0 but less than 0.05.

Age group (years)	**Number**	**Percent of total**
0-4	4	1
5-9	16	4
10-14	20	5
15-19	20	5
20-24	13	3
25-29	22	6
30-34	30	8
35-39	41	11
40-44	44	11
45-49	45	12
50-54	47	12
55-59	26	7
60-64	25	6
65-69	25	6
70-74	10	3
75-79	1	T
80 and older	1	T

Angler Trip Satisfaction

How anglers feel about their fishing experience is important to the success of a fishery. Angler responses help fisheries managers determine if current management practices and regulations are providing a fishery that meets angler needs and expectations.

In terms of rating a trip based on catching the numbers of fish they were expecting, median angler trip ratings for 2002 were generally " good" (median=2), with the median value being " fair" (median=3) in April and September (Table 35). When the average number of walleye harvested per angler was factored in, trip rating based on numbers of fish anglers were expecting generally improved as the average number of fish harvested per angler increased. Angling parties averaging 0 walleye harvested per angler had a median trip rating response of " fair" while parties harvesting a limit of walleye had a median trip rating of " excellent" (Table 36) . Median trip rating based on sizes of fish anglers were expecting to catch, among months, was similar to median trip ratings based on numbers of fish anglers were expecting to catch (Tables 35 and 37) . The median trip rating for the April-September 2002 period based on sizes of fish anglers were expecting to catch was " good" , with the overall patterns in trip rating among months being similar for numbers and sizes of fish anglers were expecting to catch. The only difference in trip rating based on numbers vs. sizes of fish anglers were expecting to catch occurred during August. Median trip rating based on numbers of fish anglers were expecting to catch was " good" (median of 3) during August, while trip rating based on sizes of fish anglers were expecting to catch was " fair" (median=3). When the average number of walleye harvested per angler was factored in the median trip rating for angler parties averaging 0-1.9 walleye harvested per angler was " fair" , while the median trip rating for parties averaging 2-4 walleye harvested per angler was " good" (Table 38).

Table 35. Response to the question: " How would you rate your fishing today in terms of catching the numbers of fish you were expecting?" 1 = excellent, 2 = good, 3 = fair, 4 = poor, 5 = very poor, and 6 = no opinion. N is sample size and does not include " no opinion" responses.

Month	Rating your trip in terms of the numbers of fish you were expecting							
	1	2	3	4	5	6	N	Median
April	2	7	13	1	3	0	26	3
May	19	23	22	9	8	2	81	2
June	25	17	24	6	11	2	83	2
July	19	18	12	10	5	1	64	2
August	12	17	11	4	4	3	48	2
Sept.	9	7	11	10	5	0	52	3
Total	**86**	**89**	**93**	**40**	**36**	**8**	**344**	**2**
Percent	**24**	**25**	**26**	**11**	**10**	**2**		

Table 36. Response to the question: " How would you rate your fishing today in terms of catching the numbers of fish you were expecting?" compared to the average number of walleye harvested per angler. Response categories are the same as in Table 35. N is sample size does not include " no opinion" responses.

Walleye /angler	Rating your trip in terms of the numbers of fish you were expecting						
	1	2	3	4	5	N	Median
0	8	26	32	17	25	108	3
0-0.9	3	6	16	8	9	42	3
1-1.9	4	14	21	5	2	46	3
2-2.9	13	12	10	5	0	40	2
3-3.9	13	12	7	5	0	37	2
4	45	18	6	0	0	69	1

Table 37. Response to the question: " How would you rate your fishing today in terms of catching the sizes of fish you were expecting?" Response categories are the same as in Table 35. N is sample size and does not include " no opinion" responses.

Month	Rating your trip in terms of the sizes of fish you were expecting							
	1	2	3	4	5	6	N	Median
April	4	2	6	5	3	0	20	3
May	28	24	17	3	4	7	76	2
June	21	27	19	10	7	1	84	2
July	6	23	17	2	1	2	49	2
August	4	18	15	7	6	3	50	3
Sept.	5	6	10	2	14	0	39	3
Total	**68**	**100**	**84**	**29**	**35**	**13**	**316**	**2**
Percent	**21**	**30**	**26**	**9**	**11**	**4**		

Table 38. Response to the question: " How would you rate your fishing today in terms of catching the sizes of fish you were expecting?" compared to the average number of walleye harvested per angler. Response categories are the same as in Table 35. N is sample size and does not include " no opinion" responses.

Walleye /angler	Rating your trip in terms of the sizes of fish you were expecting						
	1	2	3	4	5	N	Median
0	11	24	27	16	24	102	3
0-0.9	4	6	11	3	7	31	3
1-1.9	12	12	22	4	3	53	3
2-2.9	11	11	10	4	1	37	2
3-3.9	13	17	6	1	0	37	2
4	15	27	8	1	0	51	2

When anglers were asked to consider all factors when stating their level of satisfaction with their fishing trip, the median trip rating for the April-September period was " moderately satisfied" (median of 2; Table 39) . Eighty percent of angling parties indicated some degree of satisfaction, surpassing the Lake Sharpe Strategic Plan objective of 70%. As when rating a trip based on numbers or sizes of fish anglers were expecting, overall trip satisfaction increased as the average number of walleye harvested per angler increased (Table 39). The median trip rating for angling parties harvesting 0-1.9 walleye/angler was " slightly satisfied" , angling parties harvesting 2.0-2.9 walleye/angler were " moderately satisfied" and angling parties harvesting 3-4 walleye/angler were " very satisfied" (Table 40).

Table 39. Response to the question: " Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral (neither satisfied or dissatisfied, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include " no opinion" responses.

Month	Satisfied			Neutral	Dissatisfied			N.O	N	Median
	1	2	3	4	5	6	7	8		
April	5	1	5	3	1	0	2	1	17	3
May	33	22	11	2	1	4	2	0	75	2
June	17	25	15	6	4	6	1	0	74	2
July	27	18	10	2	2	0	1	0	61	2
August	6	11	15	3	3	3	1	0	42	3
Sept.	7	7	3	3	3	3	4	0	31	3
Total	**95**	**84**	**59**	**19**	**14**	**16**	**12**	**1**	**299**	**2**
Percent		**80**		**6**		**14**				

Table 40. Response to the question: " Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per angler. N is sample size and does not include " no opinion" responses. Response categories are the same as in Table 39.

Walleye /angler	Satisfied			Neutral	Dissatisfied			N	Median
	1	2	3	4	5	6	7		
0	20	19	23	6	7	6	8	89	3
0-0.9	3	5	7	4	3	2	3	27	3
1-1.9	7	14	17	5	1	5	1	50	3
2-2.9	13	11	6	2	2	3	0	37	2
3-3.9	21	14	4	2	0	0	0	41	1
4	30	20	1	0	1	0	0	52	1
Percent		80		6		14			

In addition to questions concerning overall trip satisfaction and trip rating based on numbers or sizes of fish anglers were expecting, anglers were asked questions to determine preferences for managing the Lake Sharpe smallmouth bass fishery. Appendix 4 contains a complete list of angler satisfaction, trip rating, and preference questions included in 2002 angler interviews on Lake Sharpe. When asked if they would be in favor of increasing the abundance of smallmouth bass longer than 16 inches in Lake Sharpe, 48% of anglers responded " yes" , 27% responded " no" and 25% stated they had " no opinion" on the issue (Table 41).

when asked if they would be in favor of a regulation requiring all smallmouth bass longer than 12 inches to be released during all months of the year (12-inch maximum length limit), 48% of anglers asked responded " yes" , 28% responded " no" and " 24%" stated they had no opinion on the issue (Table 42). When anglers were asked if they would be in favor of a regulation requiring all smallmouth bass shorter than 16 inches to be released during all months of the year (16-inch minimum length limit), response percentages were similar to those asking about a 12-inch maximum length limit with " yes" , " no" , and " no opinion" response percentages of 49%, 28%, and 24%, respectively (Table 43).

The highest percentage of " yes" responses for a regulation option was generated when anglers were asked in they would be in favor of a regulation requiring all smallmouth bass between 12 inches and 16 inches to be released during all months of the year (12-16-inch protected slot). Fifty-eight percent of anglers asked this question were in favor of implementing a 12- to 16-inch protected slot length limit to protect smallmouth bass on Lake Sharpe, while 24% were not in favor of this regulation option and 18% had no opinion (Table 44). The high percentage of " no opinion" responses to questions about smallmouth bass regulation preferences may mean the issue of smallmouth bass management is not an issue for approximately 25% of anglers.

Table 41. Response to the question: " Would you be in favor of increasing the abundance of smallmouth bass longer than 16 inches in Lake Sharpe by using length limits?" N is sample size and responses are listed as percentages of total responses.

	Month						
Response	**April**	**May**	**June**	**July**	**August**	**Sept.**	**Total**
N	26	83	84	65	51	39	**347**
Yes (%)	69	52	37	45	59	44	**48**
No (%)	23	21	26	39	25	26	**27**
No opinion	8	27	37	17	16	31	**25**

Table 42. Response to the question: " If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass longer than** 12 " to **be released during all months of the year?"** N is sample size and responses are listed as percentages of total responses.

	Month						
Response	**April**	**May**	**June**	**July**	**August**	**Sept.**	**Total**
N	18	75	75	61	42	30	**301**
Yes (%)	72	51	51	36	52	40	**48**
No (%)	22	23	24	39	24	37	**28**
No opinion	6	27	25	25	24	23	**24**

Table 43. Response to the question: " If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass shorter than 16 inches to be released during all months of the year?" N** is sample size and responses are listed as percentages of total responses.

	Month						
Response	**April**	**May**	**June**	**July**	**August**	Sept.	**Total**
N	20	81	83	51	52	37	**324**
Yes (%)	55	57	43	45	42	54	**49**
No (%)	25	27	28	39	25	19	**28**
No opinion	20	16	29	16	32	27	**24**

Table 44. Response to the question: " If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass between 12 inches and 16 inches to be released during all months of the year?"** N is sample size and responses are listed as percentages of total responses.

	Month						
Response	**April**	**May**	**June**	**July**	**August**	**Sept.**	**Total**
N	16	68	74	56	41	25	**281**
Yes (%)	75	62	51	59	61	48	**58**
No (%)	6	19	34	23	17	36	**24**
No opinion	19	19	15	18	22	16	**18**

WALLEYE FISHERY STATUS AND 2003 OUTLOOK

Walleye abundance (indexed by gill net CPUE) and growth have been relatively constant on Lake Sharpe during the 1998-2002 period (Tables 3, 6, and 7). Standard gill-net survey CPUE of walleye has ranged from 21.5 in 1998 to 28.3 in 2001. The 2002 mean walleye gill net CPUE of 24.1 fish/net-night, appears lower than the 2001 value of 28.3 fish/net-night but with the amount of variability in CPUE among nets, there was no significant difference in CPUE. Walleye recruitment in Lake Sharpe has generally been characterized as highly variable (Johnson and Lott 1999; Johnson and Lott 2000). Though walleye year-class strength varies greatly from year to year, some degree of recruitment occurs each year. The catch of age-0 and age-1 walleye in the gill net survey from 1998-2002 documents the presence of three consecutive year classes from 1998-2000, that currently comprise the bulk of fish in the catchable portion of the walleye population (Figure 4, Table 5). Walleyes from the 1999 and 2000 year classes comprised the majority of fish between 300 and 380 mm in the August 2002 gill net catch, while walleye between 381 and 457-mm in length are mostly from the 1998 year class. The majority of walleye >457-mm in length are from the 1994 and 1995 year classes (Figure 4, Table 5). Walleye in the 1999-year class should surpass 381-mm (15 inches) in length some time during 2003.

Walleye reproductive success during 2002, as indicated by seining, gill netting, and fall electrofishing, was low (Table 13) . Mean fall nighttime electrofishing CPUE for age-0 walleye in 2002, at 12.6 walleye/h, was lower than values generated for 1995-2001 (Table 12)) and the mean age-0 walleye gill net CPUE for 2001, at 0.04 walleye/net-night, was also the lowest in the 1995-2002 period.

A measurable 2001-year class was evident from the standard gill net catch with these fish being between 200 and 280 mm during August 2002. Walleye *Wr* values in Lake Sharpe in 2002 were within or above the range of values observed during the 1997-2002 period for all length categories of walleye (Table 9) . Relative weight values for stock-to-quality-length walleyes collected in the 2002 gill net survey were significantly lower than for fish of the same length category in the 2001 survey, though still within the range observed during the 1997-2002 period.

Mean walleye catch rates by anglers that approach one walleye/hour are due partly to the seasonal availability of age-0 gizzard shad in Lake Sharpe and seasonal changes in water temperature. Age-0 gizzard shad enter the prey base in June or July but the majority of age-0 shad die each winter due to cold water temperatures. Therefore, walleye catch rates are generally highest following the walleye spawning season and before age-0 gizzard shad enter the prey base. High water temperatures in July and August also contribute to lower walleye catch rates during these months. The current Lake Sharpe regulation package has helped maintain the quality of the Lake Sharpe walleye population in the presence of exceptional walleye catch rates by anglers.

Angling pressure during the April-September 2002 daylight period, at an estimated 89,827 angler trips, was below the objective established in the Lake Sharpe Strategic Plan. However, estimated walleye harvest, at 144,044 fish, exceeded the plan objective of 100,000 walleye by 44% (Table 21). while not documented by survey results, fishing pressure and associated walleye harvest in October and November 2002 was high, compared to other years, and harvest of walleye during the September-November 2002 period may have reduced the abundance of the 1998 year class prior to the 2003 fishing season. The overall mean walleye harvest rate for the April-September 2002 daylight period was 0.37 walleye/angler-h (Table 34), similar to the strategic plan goal of 0.30 walleye/angler-h. Eighty percent of angling parties indicated some degree of satisfaction, surpassing the Lake Sharpe Strategic Plan objective of 70%.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Walleye regulations currently in effect have been successful at reducing harvest enough to maintain the quality of the Lake Sharpe walleye fishery. The 15-inch minimum length limit in effect during all months except July and August has increased the average length of walleye in the angler harvest and added stability to the walleye population by keeping walleye in the population longer. However, during 2003, the one walleye ? 457-mm in length restriction will likely have little effect at reducing harvest of walleye 457 mm. Abundance of walleye in the 1994-1996 year classes will be low enough that few anglers will catch more than one walleye ? 457-mm in length during a fishing trip. Even though the one walleye ? 457-mm in length restriction may have little effect on reducing harvest of walleye, the regulation still helps instill in anglers the value of large walleyes. It is hoped that anglers will eventually begin changing their harvest patterns and begin voluntarily releasing walleye longer than 457-mm in length.

Fall age-0 electrofishing catch rates are often higher in the portion of Lake Sharpe from Hipple Lake upstream to Oahe Dam, than in the lower portion of the reservoir. Upper Lake Sharpe serves as an important spawning and rearing area for walleye and other species. Concerns about habitat degradation as a result of channel aggradation downstream of the Bad River must be addressed to protect this important spawning and rearing area in Lake Sharpe.

Smallmouth bass were introduced into various sections of Lake Sharpe from 1980-1991. The population is now well established and strong year classes produced from 1994-1997 supported the majority of the angler harvest in 2002. The new 305-457-mm (12-18-inch) protected slot length limit, to be implemented in 2003, will protect the majority of the fish in these year classes from harvest, while allowing harvest of younger year classes until they reach approximately age 4. The Goal of the new smallmouth bass regulations is to increase the abundance of smallmouth bass longer than 18 inches in length to develop a quality catch-and-release smallmouth bass fishery. Protecting smallmouth bass between 305 and 457-mm in length, while allowing harvest of bass less than 305-mm in length should help restructure the pounds of smallmouth bass per acre to accomplish this goal.

RECOMMENDATIONS

1. Continue and improve fish population and angler use, harvest and preference surveys on an annual basis. Specifically, increase efforts to gather quality data on the smallmouth bass fishery to evaluate regulations placed in effect for 2003 and continue to work at developing adequate indices of walleye year class strength at age-0 and age-1.

2. Work closely with the United States Army Corps of Engineers and state and local governments to address issues concerning the degradation of fish habitat in the middle zone of Lake Sharpe associated with the Bad River confluence.

3. Continually evaluate current walleye and smallmouth bass regulations to determine regulation appropriateness and effectiveness at maintaining the quality of the Lake Sharpe walleye fishery.

4. Establish better working relationships with local governments and economic interests, and convey the limited harvest potential of fisheries resources to these groups.

5. Age walleye captured during the standard gill net survey from both scales and otoliths to improve estimates of growth rates and population age structure. Walleye in the standard gill net survey should also be sexed to determine differences in growth of walleye between sexes, for use in modeling regulation effectiveness.

6. Promote under-utilized species such as channel catfish and white bass to increase angler harvest opportunities without increasing walleye harvest.

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APPENDICES

Appendix 1. Common and scientific names of fishes mentioned in this report.

Common Name	Abbreviations	Scientific Name
Bigmouth buffalo	BIB	*Ictiobus cyprinellus*
Black bullhead	BLB	Ameiurus *melas*
Black crappie	BLC	*Pomoxis nigromaculatus*
Blue catfish	BCF	Ictalurus furcatus
Bluegill	BLG	*Lepomis macrochirus*
Blue sucker	BSR	*Cycleptus elongatus*
Bluntnose minnow	BLM	*Pimephales* notatus
Channel catfish	CCF	*Ictalurus* punctatus
Chinook salmon	FCS	*Oncorhynchus* tshawytscha
Common carp	COC	*Cyprinus carpio*
Emerald shiner	EMS	*Notropis atherinoides*
Fathead minnow	FHM	*Pimephales promelas*
Freshwater drum	FRD	*Aplodinotus grunniens*
Gizzard shad	GZD	*Dorosoma cepedianum*
Goldeye	GOE	*Hiodon alosoides*
Johnny darter	JOD	*Etheostoma nigrum*
Lake herring	LAH	*Coregonus artedii*
Largemouth bass	LMB	*Micropterus salmoides*
Northern pike	NOP	*Esox Lucius*
Rainbow smelt	RBS	*Osmerus mordax*
Rainbow trout	RBT	*Oncorhynchus mykiss*
Red shiner	RES	*Cyprinella lutrensis*
River carpsucker	RIC	*Carpiodes carpio*
Sand shiner	SAS	*Notropis* stramineus
Sauger	SAR	*Stizostedion canadense*
Shorthead redhorse	SHR	*Moxostoma macrolepidotum*
Shortnose gar	SHG	*Lepisosteus platostomus*
Shovelnose sturgeon	SHS	*Scaphirynchus platorynchus*
Smallmouth bass	SMB	*Micropterus dolomieu*
Smallmouth buffalo	SAB	*Ictiobus bubalus*
Spottail shiner	SPS	*Notropis hudsonius*
Walleye	WAE	*Stizostedion vitreum*
White bass	WHB	*Morone chrysops*
White crappie	WHC	*Pomoxis annularis*
White sucker	WHS	*Catostomus commersoni*
Yellow perch	YEP	*Perca flavescens*

Appendix 2. Standard weight equations used for relative weight (Wr) calculations. Length is in millimeters, weight is in grams, and logarithms are to the base 10.

Walleye	$Log W_s=3.180LogTL-5.453$
Sauger	$Log W_s=3.157LogTL-5.446$
Channel catfish	$Log W_s=3.294LogTL-5.194$
Yellow perch	$Log W_s=3.114LogTL-5.138$
White bass	$Log W_s=3.230LogTL-5.386$

Appendix 3. Channel catfish, white bass, and yellow perch proportional stock density (PSD), relative stock density (RSD-P and RSD-M), and relative weight (*Wr*) for 1997-2002, from Lake Sharpe. Mean *Wr* values for 2002 are for stock-length fish only.

Channel catfish

Year	PSD	RSD-P	RSD-M	Wr	N
1997	35	3	0	85	108
1998	37	6	0	83	108
1999	41	4	0	83	139
2000	34	5	0	82	148
2001	27	2	0	82	135
2002	30	1	0	80	171

White bass

Year	PSD	RSD-P	RSD-M	Wr	N
1997	96	58	13	94	24
1998	94	94	22	101	18
1999	100	72	24	102	54
2000	98	83	13	99	55
2001	100	91	26	100	46
2002	68	15	8	100	71

Yellow perch

Year	PSD	RSD-P	RSD-M	Wr	N
1997	43	4	0	89	23
1998	28	6	0	91	18
1999	59	27	0	82	22
2000	22	6	0	85	36
2001	55	0	0	86	20
2002	42	8	0	77	24

Appendix 4. Angler preference and attitude questions asked in conjunction to the 2002 Lake Sharpe angler use and harvest survey.

How would you rate your fishing today in terms of catching the sizes of fish you were expecting?

How would you rate your fishing today in terms of catching the numbers of fish you were expecting?

Considering all factors, how satisfied are you with your fishing trip today?

Would you be in favor of increasing the abundance of smallmouth bass longer than 16" in Lake Sharpe by using length limits?

If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass longer than 12 " to be released during all months of the year?**

If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass shorter than 16 inches to be released during all months of the year?**

If the objective was to increase abundance of smallmouth bass longer than 16" in length, **would you be in favor of a regulation requiring all smallmouth bass between 12 inches and 16 inches to be released during all months of the year?**